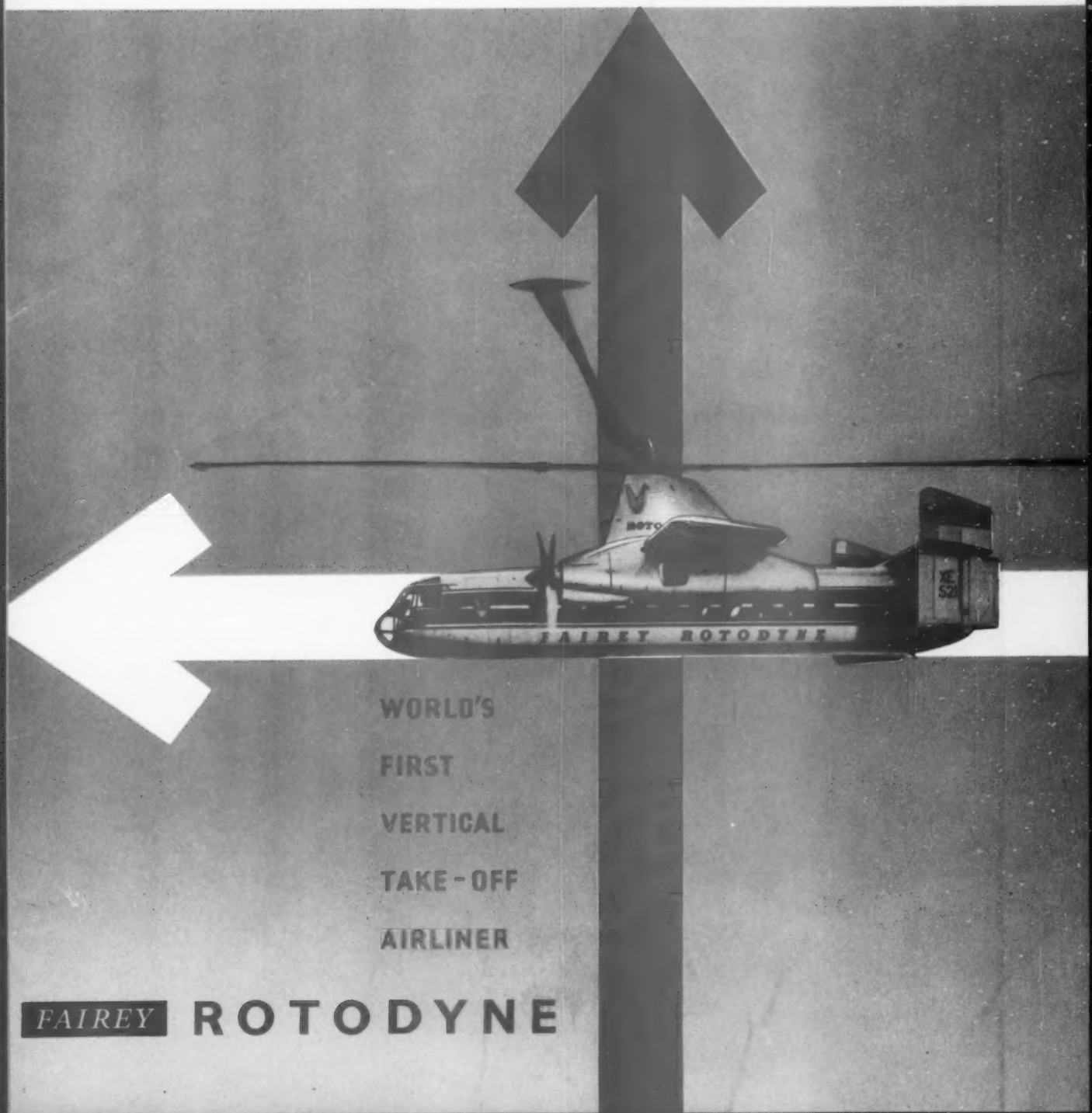
THE AEROPLANE and ASTRONAUTICS

SEPTEMBER 25, 1959

EVERY FRIDAY
ONE SHILLING
AND SIXPENCE



Somewhere, day and night, silvered by sunshine or deep in darkness, aircraft are always flying. Jet airliners such as the Comet, the Caravelle and the new de H. 121 and Turbo-props like the Vanguard, the Argosy and the Viscount, depend on Lockheed Hydraulic equipment — whilst Lockheed Avery self-sealing couplings are a household word in the Aircraft Industry.

Lockheed

REGD TRADE MARK

PRECISION PRODUCTS LTD.

LEAMINGTON SPA · WARWICKSHIRE

Products from SMITHS

AVIATION DIVISION

3

This is the third of a series of six insets appearing in this journal during the next six months. The next section will be appearing on the 20th November, 1959.

AUTOPILOT

Smiths
S.E.P.2 Autopilot Flight Panel

The S.E.P. 2, a modern electric autopilot, is designed to control modern transport aircraft through all stages of flight. The S.E.P. 2 provides full flight stabilization and manoeuvring control in both pitch and azimuth—and facilities for locking to constant heading, indicated airspeed and pressure altitude, and coupling to V.O.R. and I.L.S. with fully automatic approach.

Heading Selector

The Heading Selector controls the heading of the aircraft when under autopilot. Heading can also be preselected; the aircraft will hold its original heading until an "alter heading" button is pressed. The Heading Selector is in the form of a compass repeater, with a heading selector knob at the bottom right hand corner.

Gyro Unit

The S.E.P. 2 operates on the rate/rate principle. Only rate gyros are used. This system provides very smooth control, and the rugged rate gyros give a very long life. Currently 3,000 hours between overhauls is achieved on all units of the S.E.P. 2, while some non-moving parts have a considerably longer life.

Locking Unit

The S.E.P. 2 uses magnetic amplifiers throughout. These ensure long life and reliability. The rack mounted locking unit contains all the circuits and amplifiers associated with airspeed and height locking, and radio coupling.

SMITHS FLIGHT SYSTEM

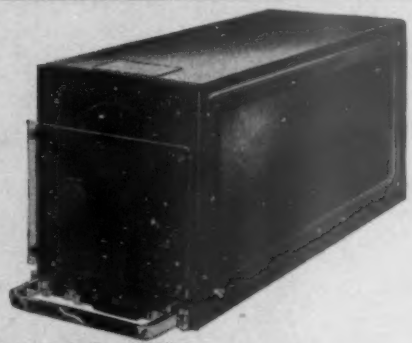
The Smiths Flight System is designed to provide a complete rationalised installation for the instrumental control of flight of large transport aircraft. It is available throughout all stages of normal manual, flight director and fully automatic operation. Emphasis in the design has been placed in simplicity and safety of use; switching and setting operations have been reduced to a minimum. A special feature is that such switching and setting as is necessary is common to both the flight director and autopilot. Thus, the autopilot can be monitored by reference to the flight director, and transition from automatic to manual flight is simplified.

Director Horizon

The attitude pitch and roll display is similar to the conventional artificial horizon. Flight director attitude demand pointers are added to the display in such a way that the Flight Director is naturally combined with the flight instrument.

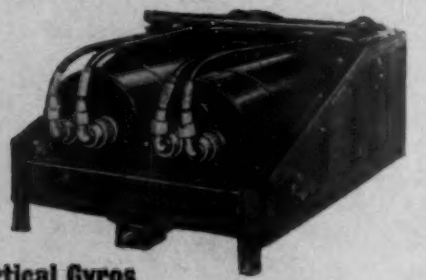
Beam Compass

The Beam Compass Indicator of the Smiths Flight System is essentially a Compass display which can be orientated to any reference direction. Under free flight conditions this is the required heading. When it is used in conjunction with a radio defined track, the Beam Compass shows the heading and position of the aircraft relative to the radio track line.



Compass Amplifier

Those units of the flight system that are not panel instruments are rack mounted. The compass amplifiers, which are duplicated, contain a master compass indicator, and the facilities for adjustment on compass swinging. Each compass amplifier can provide up to five synchro outlets of aircraft heading, that can be fed to other aircraft equipment.



Vertical Gyros

The attitude information for the Flight System is obtained from two remotely situated vertical gyros. These gyros, one feeding each half of the flight system, are hermetically sealed and rack mounted in anti-vibration mountings. Each gyro has two independent pick-offs in both roll and pitch, so that stabilizing information can be fed to other aircraft equipment such as weather radar.

Precision Directional Gyro

The Precision Directional Gyro is an azimuth gyro developed specially to provide consistent heading data with a normal maximum random drift rate of ± 3° per hour. Its performance makes it eminently suitable for trans-polar airline operations. The P.D.G. can be used on its own or substituted for the azimuth gyros in the flight system, and a panel mounted Compensator Unit fitted to compensate for the earth's rotation and other navigational factors.

Radial Magnetic Indicator

The Radial Magnetic Indicator has two needles, coloured distinctively red and green, that indicate the relative bearings of these same stations over a servo driven compass card. The needles can be fed from either A.D.F. or V.O.R. equipment.

Omni-Bearing Selector

The O.B.S. is a panel mounted instrument for the selection of V.O.R. radials. The radials are selected on a counter, and the instrument incorporates to/from switching. Deviation signals can be fed to a deviation indicator, or the plan position indicator of an Integrated Flight System.

Omni-Bearing Indicator

The O.B.I., used in conjunction with an O.B.S., indicates the magnetic bearing of a V.O.R. station from the aircraft.

Radial Magnetic Selector

The R.M.S. has as its basis, a Radial Magnetic Indicator presentation. To this presentation is added a 360° counter and settable lubber to give selected track or V.O.R. radial. Thus R.M.I. and V.O.R. information are combined in one instrument. A special feature is that track selection operates with A.D.F. in addition to V.O.R.

NAVIGATION INSTRUMENTS

Kelvin Hughes Air Mileage Unit High Range

Developed in collaboration with the Ministry of Supply, the Air Mileage Unit is designed for use with the Air Position Indicator and Air Mileage Indicator. It provides electrical output proportional to true air distance which the A.P.I. resolves into latitude and longitude. Also an electrical impulse every 1/10th nautical mile to the A.M.I. to indicate air miles flown.

Kelvin Hughes E.2 Series Compass

A small lightweight compass suitable for use in all types of aircraft; vertical card presentation; calibrated every 10°, liquid damped. Three basically similar types: E.2.A. and E.2.B. providing correction for co-efficients A, B and C and E.2 having additional correction for co-efficient R. E.2.B. has internal light.

Kelvin Hughes P.11 Compass

A liquid damped compass intended for direct viewing at short range. The compass scale is engraved in 2° divisions and fully marked at cardinal and quadrantal points. The magnet assembly is supported on a pivot in a sapphire jewel cup and has freedom of movement of ± 20° from the horizontal. Fully temperature compensated for a range of —40°C to +70°C.

Kelvin Hughes P.12 Compass

Designed for roof mounting, the P.12 Grid Steering Compass provides a clear view of the Compass face for either first or second pilot. Fully compensated over a temperature range of —40°C to +70°C. The compass can be supplied with either luminous or fluorescent markings.

G.5 Compass Indicator

The Indicator shown is part of the Kelvin Hughes G.5 Compass System which, working in conjunction with a suitable Reference Gyro, provides heading information which may be relayed to other equipment, such as Flight Director, Auto-pilot, etc. The indicator may be used as a directional gyro when required.

G.5. Compass Detector Unit

The Detector Unit as used in the Kelvin Hughes G.5 Compass System and Smiths Flight System. The Unit utilizes two pairs of sensitive elements arranged at 90° to one another, pendulously suspended on gymbals; the whole assembly immersed in oil to provide mechanical damping.

Specially printed binders are available on request. Please write on your business letterheading for this binder. Additional copies of this inset and the previous two can be sent direct to members of your organisation who require them. Please detail them on your application.

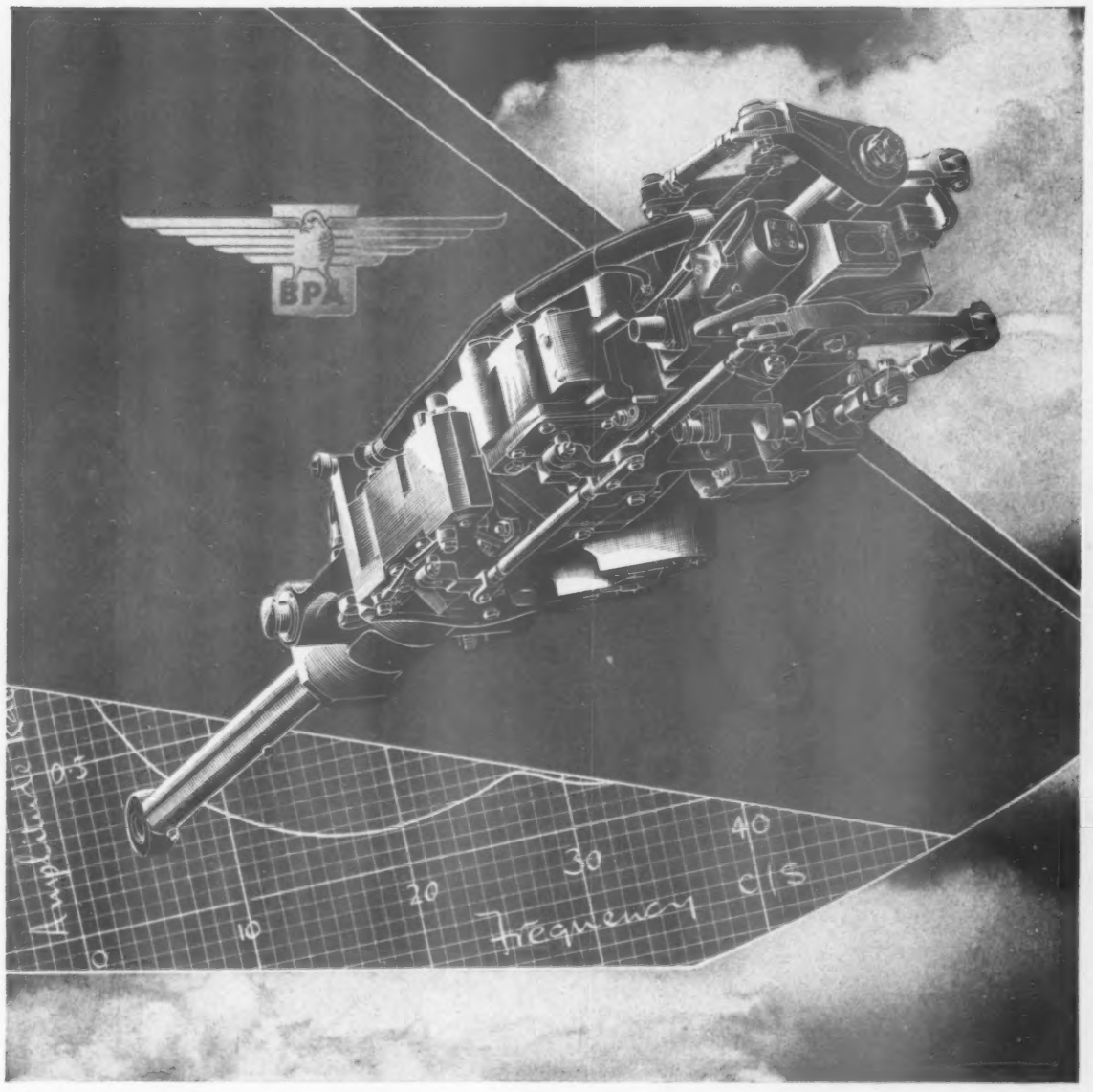
SMITHS AVIATION DIVISION

SALES AND SERVICE, CRICKLEWOOD, LONDON, NW2
Telephone Gladstone 3333

KELVIN & HUGHES (AVIATION), WINCHESTER ROAD, BASINGSTOKE, HANTS
Telephone Basingstoke 690

WAYMOUTH GAUGES AND INSTRUMENTS, STATION ROAD, GODALMING, SURREY
Telephone Godalming 1330

KLG AVIATION PRODUCTS, PUTNEY VALE, LONDON SW15
Telephone Putney 8111



Power Controls

The powered flying control unit illustrated operates the ailerons of the Blackburn NA.39 strike aircraft, in which low-level precision control is an essential requirement. It consists of a tandem ram controlled by rotary valves. Separate hydraulic supplies to the two sides of the ram ensure duplication, and the unit embodies an integral autostabilizer/auto-pilot actuator.

BOULTON PAUL AIRCRAFT LTD.

WOLVERHAMPTON, ENGLAND

THE CREW · THE PASSENGERS · THE AIRLINE OPERATORS

FROM EVERY POINT OF VIEW, CONVAIR'S 880 JET-LINER...

Years ahead for years to come

Convair's 880 Jet-Liners, powered by General Electric CJ-805 engines, incorporate advanced design and engineering features that are as much as five years ahead of any commercial transport now in production. A "pilot's plane," a delight to ride in, the 880 also meets the most exacting economic and operational requirements of airline operators. From *everyone's* point of view, the 880 Jet-Liner, built by Convair, a Division of General Dynamics Corporation, will bring you jet travel that is *years ahead for years to come!*

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION

First to offer Convair 880 or 600 Jet-Liner service will be TWA, DELTA, TRANSCONTINENTAL (Argentina), REAL-AEROVIAS (Brazil), S.A.S., SWISSAIR, AMERICAN

At 1959 PARIS Air Display

DASSAULT

INTRODUCES

MIRAGE III

IN PRODUCTION FOR FRENCH AIR FORCE

VERSATILE MACH 2 AIRCRAFT

- INTERCEPTION AT HIGH ALTITUDE
- AIR INTERDICTION
- TACTICAL SUPPORT
- LONG RANGE ATTACK
- RECONNAISSANCE
- TRAINING (TWO SEATER)

ETENDARD IV

IN PRODUCTION FOR FRENCH NAVY

SUPERSONIC NAVAL STRIKE FIGHTER

- LONG RANGE (FLIGHT REFUELLING)
- POWERFUL ARMAMENT
- RECONNAISSANCE
- SLOW SPEED FOR OPERATION ON LIGHT CARRIERS

Générale Aéronautique Marcel Dassault

78, QUAI CARNOT - SAINT-CLOUD (Seine-et-Oise) FRANCE

Tél. PARIS MOLITOR 36-80

Simplicate and add more lightness

The technique of milling complete structural elements from the solid is basically in accord with the celebrated precept 'Simplicate and add more lightness'. But integral construction calls for skill and equipment that in themselves are far from simple – and demands them jointly from the aircraft manufacturer and the material supplier.

Noral's leadership in equipment is backed by unsurpassed manufacturing experience and research facilities. Why not avail yourself of these advantages?

Noral

NORTHERN ALUMINIUM COMPANY LTD

BUSH HOUSE · ALDWYCH · LONDON WC2 · TEL: TEMPLE BAR 9430

An Aluminium Limited Company

Always taking a weight off somebody's mind!

LEFT *Noral leadership is exemplified by this 144 in. hot mill, now being installed in our Rogerstone Works. This mill will roll plate up to 10 ft. wide, and will be the biggest aluminium mill in Europe.*

BELOW *One of the wing-skin panels for the Vanguard being machined from Noral B26S plate 2 in. thick.*

(By Courtesy of Vickers Ltd.)

TBW/233

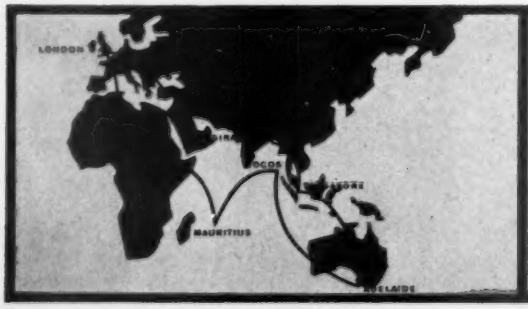
New Lockheed Super Hercules
Big brother of U.S. Tactical Airlift champ

An ocean-spanning logistic support transport, the GL-207 Super Hercules is a "stretch" version of the C-130 Hercules — famous for its headline-making feats in over two years of service with USAF's Tactical Air Forces.

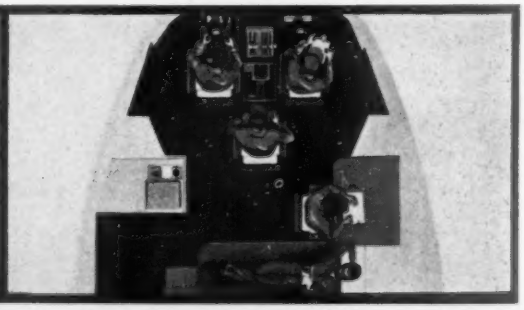
The GL-207 Super Hercules has a fuselage 23 feet longer than its brawny brother's. Its wing span is 12 feet greater... its propeller-diameter has been expanded by 2½ feet... internal fuel capacity has been increased to 10,236 gallons for greater range (pylon tanks add another 1800 gallons).

Powered by four new GM-Allison T-61 Prop-Jet engines, the Super Hercules provides nonstop trans-Atlantic and trans-Pacific transport for personnel, vehicles, palletized/containerized freight, missiles, and general cargo. Maximum payload: 78,000 pounds.

The GL-207 Super Hercules will come off production lines at Lockheed's Georgia Division. Like all Lockheed aircraft, the Super Hercules is designed for long life, easy maintenance, and low cost of operation. Result: maximum airlift, for minimum expenditure.

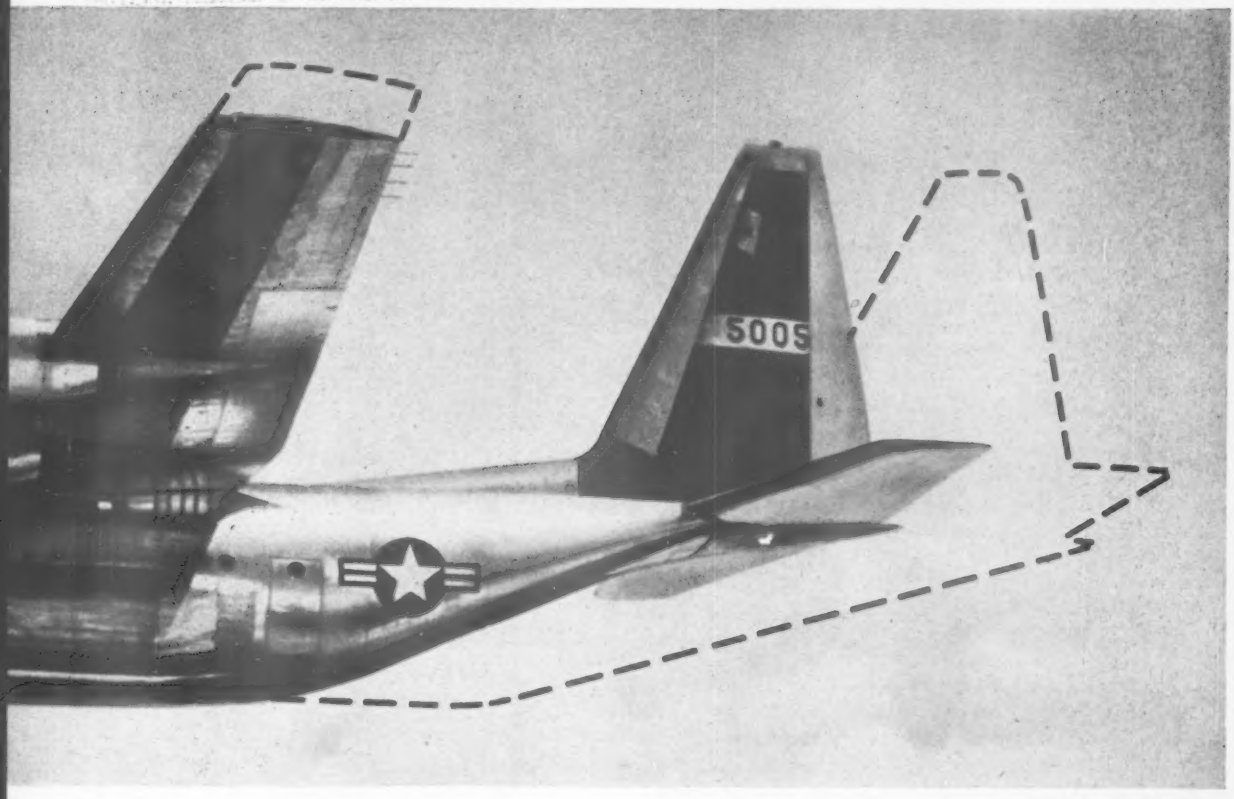


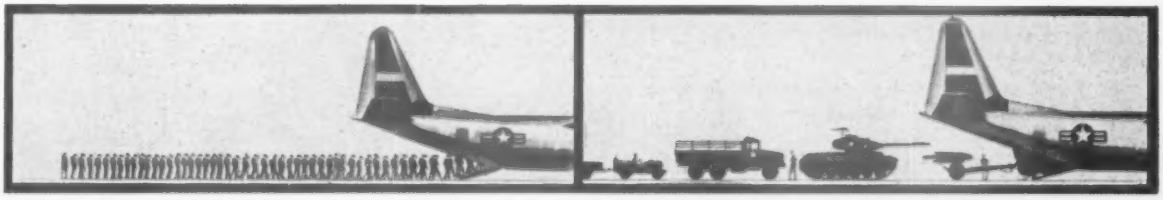
Transporting 45,000 lbs 9,886 n. m. from London to Adelaide via Masira and Singapore takes 31.5 hrs block time in Super Hercules. For 64,600 lbs haul from London to Adelaide via Kano, Entebbe, Mauritius and Cocos block time is 35.6 hrs over 10,900 n. m.



Crew efficiency on long flights is assured by flight station design approved by experienced transport pilots. Super Hercules' crew compartment includes relief crew sleeping space, galley facilities for hot meals in flight.

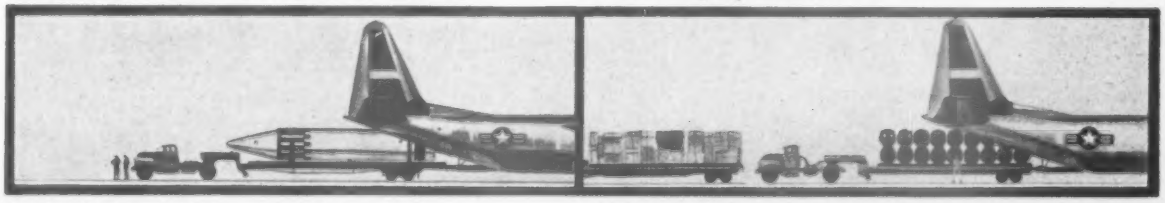
Dotted line shows size of GL-207 Super Hercules, superimposed over now-in-service C-130 Hercules.





152 combat-ready troops, or 116 paratroopers can be transported in the GL-207. With airline type seats, the Super Hercules can carry 105 persons comfortably.

Combat vehicles can be driven up the hydraulically controlled ramp-door of the end-loading GL-207 Super Hercules — a vital time-saver in emergency situations.



Big ballistic missiles — assembled, with boosters, on trailers, or dollies — fit easily into the huge pressurized cargo compartment of the GL-207 Super Hercules.

Assorted cargo — runway matting, jet engine containers, fuel and oil drums, etc. — can be speedily loaded onto Super Hercules' truck-high cargo floor.

LOCKHEED

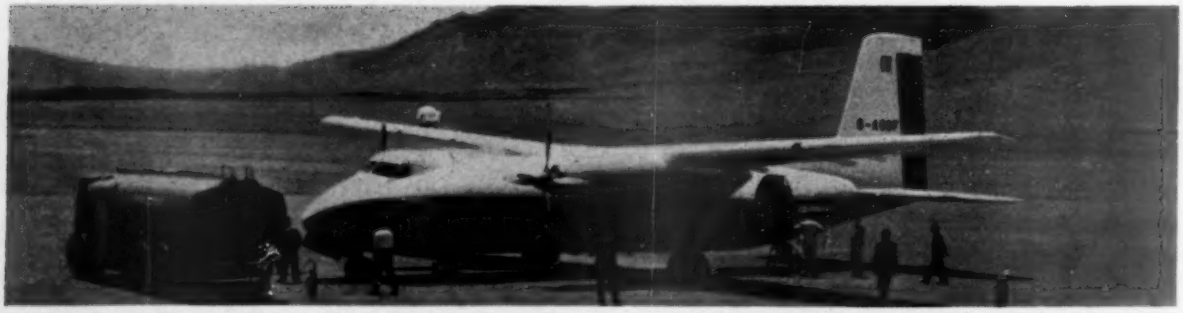
JET TRANSPORTS · JET FIGHTERS · JET TRAINERS · COMMERCIAL & MILITARY PROP-JET TRANSPORTS · ROCKETRY BALLISTIC MISSILE RESEARCH & DEVELOPMENT · WEAPON SYSTEM MANAGEMENT · ANTI-SUBMARINE PATROL AIRCRAFT · NUCLEAR-POWERED FLIGHT · ADVANCED ELECTRONICS · AIRBORNE EARLY-WARNING AIRCRAFT · AIRPORT MANAGEMENT · NUCLEAR REACTOR DESIGN & DEVELOPMENT · GROUND SUPPORT EQUIPMENT · WORLD-WIDE AIRCRAFT MAINTENANCE

THINK of an airfield—

THINK of an out-of-the-way airfield anywhere up on the hillside or out in the plain. String on a half-dozen others in a regular rough-and-tumble route for a modern 47-seat aircraft. Now consider their short, unmetalled runways that defy all but one of the new jet-prop transports. Throw in a mixed traffic of passengers and freight. Assume (correctly) that your fare-payers want increasingly smooth, sophisticated flight and that your freight needs speedy, easy handling. Add it all up, take away the plodding old piston-engined veteran you first thought of, and you *must* have—

The Rolls-Royce engined HANDLEY PAGE DART

Herald



HANDLEY PAGE LIMITED · RADLETT · LONDON · READING

THE AEROPLANE and ASTRONAUTICS

VOLUME 97 NUMBER 2501 SEPTEMBER 25, 1959

Improving Communications for Peace

Without doubt the paper given in London last week before the Institute of Transport by Captain Eddie Rickenbacker, chairman of the Board of Eastern Air Lines Inc., as the sixteenth Brancker Memorial Lecture will long remain in a class of its own. The title was "World Peace through Air Transportation." It opens with a vivid recollection of the actual moment of implementation of the Armistice on the Western Front in 1918 which the youthful Rickenbacker viewed, contrary to official rulings on the matter, from his low-flying Spad while on an alleged test flight.

From the thoughts engendered by that spectacle of two grimy sets of men embracing only a few seconds after the guns ceased to fire and the enormous fountains of mud and smoke had died down, the author of the paper developed his life-long beliefs in the efficacy of air transport as a means of bringing the peoples of the earth into close neighbourliness and such improved understanding that war would become impossible.

It is to be remembered that one of our own poets has written that "Transportation is Civilisation" and in writing that pregnant phrase Kipling was telling of a period not far from us today when the affairs of this lazy little planet were run by A.B.C.—the Aerial Board of Control.

After the Battle

The first day of this week marked the end of the celebrations of Battle of Britain Week when the Royal Air Force sets out to recall the exploits of the Few and to remind the nation that were it not for the dedicated ones who spent their lives perfecting preparedness, survival of these islands and their ways of life could not have persisted. We whom they saved have to do more than remember those historic exploits. We have to remember those who were left behind.

In a letter last week Lord Knollys wrote that once again Battle of Britain Week recalls to the nation the high price paid in 1940 and following years by those for whose present welfare and for whose dependants the Royal Air Force Benevolent Fund exists. This year the Fund is 40 years old: during its four decades of work for members of the R.A.F., W.R.A.F. and their dependants in distress, the Fund has spent nearly £9 million. Public support is continuously needed to carry this on at the present high level. Moreover, calls upon the resources of the Fund are likely to increase as the multitude of veterans of the last war meet the problems that age brings.

Sir Winston Churchill, a vice-president since the founding of the Fund, wrote as follows:—

> "I am happy to send the Royal Air Force Benevolent Fund my good wishes on its 40th birthday. The Fund has given most worthy assistance to the dependants of those who served in the Royal Air Force. We should honour those who fought; we should remember the relations of those who fell."

Donations should be sent to Lord Knollys at 67 Portland Place, London, W.1.

Editor THURSTAN JAMES
Deputy Editor F. T. MEACOCK

Founder Editor (1911-1939) *C. G. Grey*

Proprietors: TEMPLE PRESS LIMITED
Chairman and Managing Director
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1.

Telephone : TERminus 3636
Telegrams : "Pressimus London Telex"
Telex : 23839

Annual Subscription Rate : United Kingdom £4 15 0
Overseas £5. Canada and U.S.A. $15.00

© Temple Press Limited, 1959. The proprietors will consider any written requests to reproduce articles and illustrations appearing in this journal. Comment and brief extracts which acknowledge *The Aeroplane and Astronautics* are permissible.

Matters of Moment

Blue Streak—D.H./Convair Link

UNDER a commercial agreement with Convair Astronautics de Havillands are sending about four engineers to Convairs every six weeks. This statement is attributed to Mr. K. Harrold, designer in charge of Blue Streak structure for de Havilland Aircraft, in a recent issue of *Convariety*, the magazine of the Convair group.

De Havillands confirm that group personnel make visits to Convair Astronautics, but will not comment in any detail on the report. But clearly an agreement for an interchange of technical information must be of great benefit to de Havillands. Reports suggest that there are similarities in the design of the Atlas and Blue Streak missiles; Atlas has pressurized propellent tanks of thin-gauge stainless steel and from photographs published Blue Streak could have a similar construction.

Technical information on the Atlas must have proved useful in designing Blue Streak. Perhaps even more useful will be access to Convair's practical knowledge of the testing, proving and developing of long-range ballistic missiles; de Havillands have no previous experience in this field.

Royal Appointments

THREE Scandinavian monarchs have been appointed Honorary Air Chief Marshals of the Royal Air Force with effect from September 15. They are His Majesty King Olav V, K.G., G.C.B., G.C.V.O., of Norway; His Majesty King Frederik IX, K.G., G.C.B., G.C.V.O., of Denmark; and His Majesty King Gustav VI, Adolf, K.G., G.C.B., G.C.V.O., of Sweden. These appointments mark the close relations existing between the R.A.F. and the three Scandinavian countries' air forces.

Norway and Denmark form the Northern Command of NATO. The Royal Norwegian Air Force was formed in 1944 by merging the air arms of the Army and Navy. When Norway was invaded in 1940 elements of its flying Services escaped to the United Kingdom, and a training base was subsequently established at Toronto, Canada. Early in the War Norwegian squadrons were flying within the Royal Air Force.

The Royal Danish Air Force came into being as such in 1950 when the Army and Navy air services were merged. Many Danish officers escaped from Denmark after the invasion of 1940 and flew with the Allied air forces during the War.

In 1954, at the request of the Danish Government, Air Chief Marshal Sir Hugh Saunders was appointed as Air Adviser to the Danish Ministry of Defence and assisted in the organization of the R.D.A.F.

Close ties also exist between the Royal Air Force and the Royal Swedish Air Force. The R.S.A.F. has been supplied with Hawker Hunters and in 1955 the Commander-in-Chief of the R.S.A.F., Lt.-General Axel Ljungdahl, was invited by the British Air Ministry to visit R.A.F. units flying the Hunter. Bristol Bloodhound surface-to-air missiles are on order for Sweden's defences and many aircraft of Swedish design, including the Draken and Lansen, have British-designed engines.

X-15 Under Power

ON September 17 the North American X-15 research aircraft made its first powered flight after being carried to 38,000 ft. under the wing of a B-52 bomber. Piloted by Mr. Scott Crossfield, the X-15 climbed to 50,000 ft. and flew at up to 1,200 m.p.h. It landed on the dry lake bed at Edwards Air Force Base.

This first powered flight followed two abortive attempts caused by difficulties with the aircraft's liquid-oxygen propellent system. Nineteen more powered flights by Scott Crossfield are scheduled to prove the stability, control and structure of the X-15 before North American hand the aircraft over for a research programme by NASA, U.S.A.F., and U.S. Navy test pilots. During this programme the X-15 will be flown close to its limits at speeds up to Mach 5 and heights up to 100 miles.

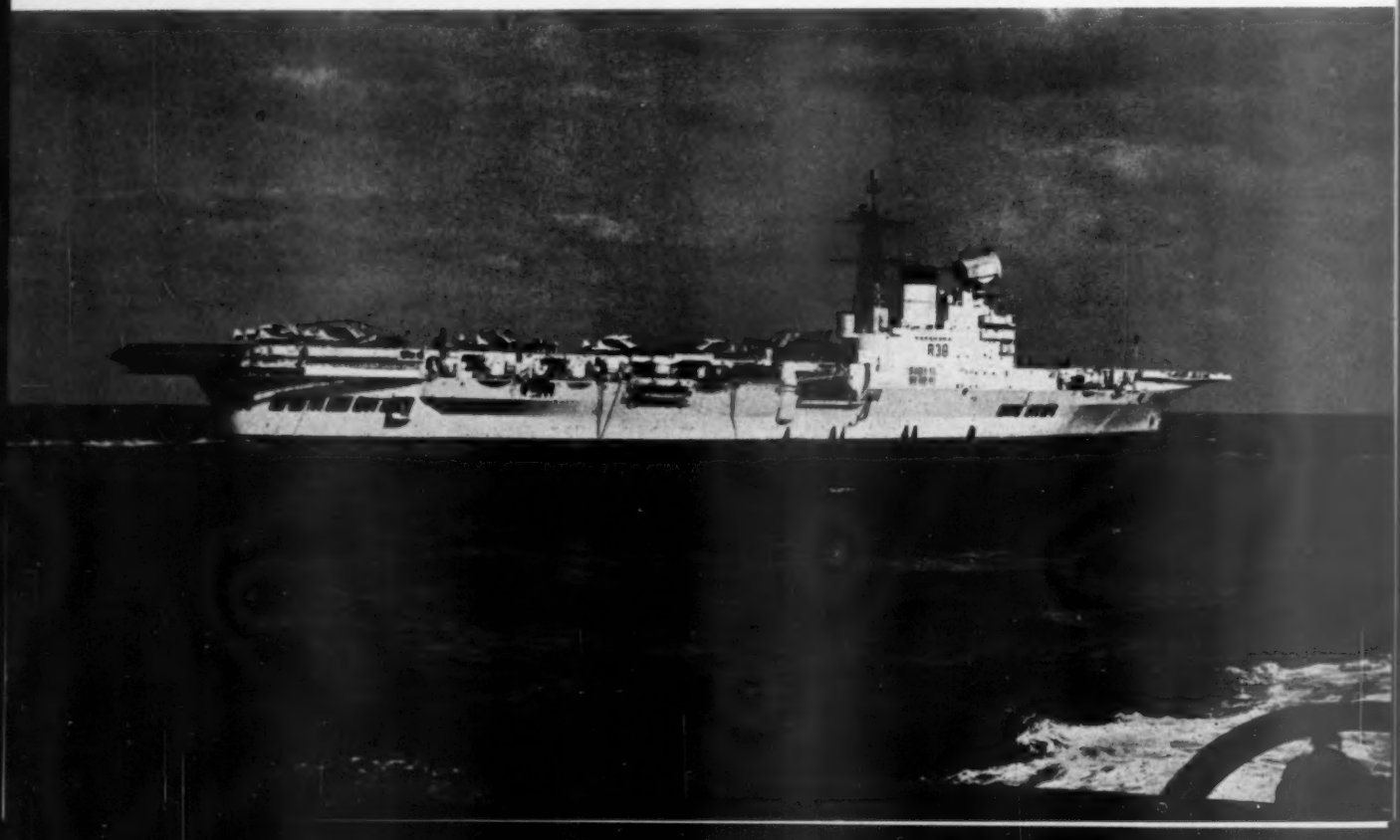
Invaluable information about the effects on pilots of weightlessness, acceleration, deceleration and controlled re-entry to the atmosphere should be gained from the X-15 programme. Controlled re-entry is very important, as information about this cannot be gained from the manned Mercury satellite which will enter the atmosphere on a ballistic trajectory. Experience with the X-15 should be particularly useful for development of the Dyna-Soar boost-glide vehicle.

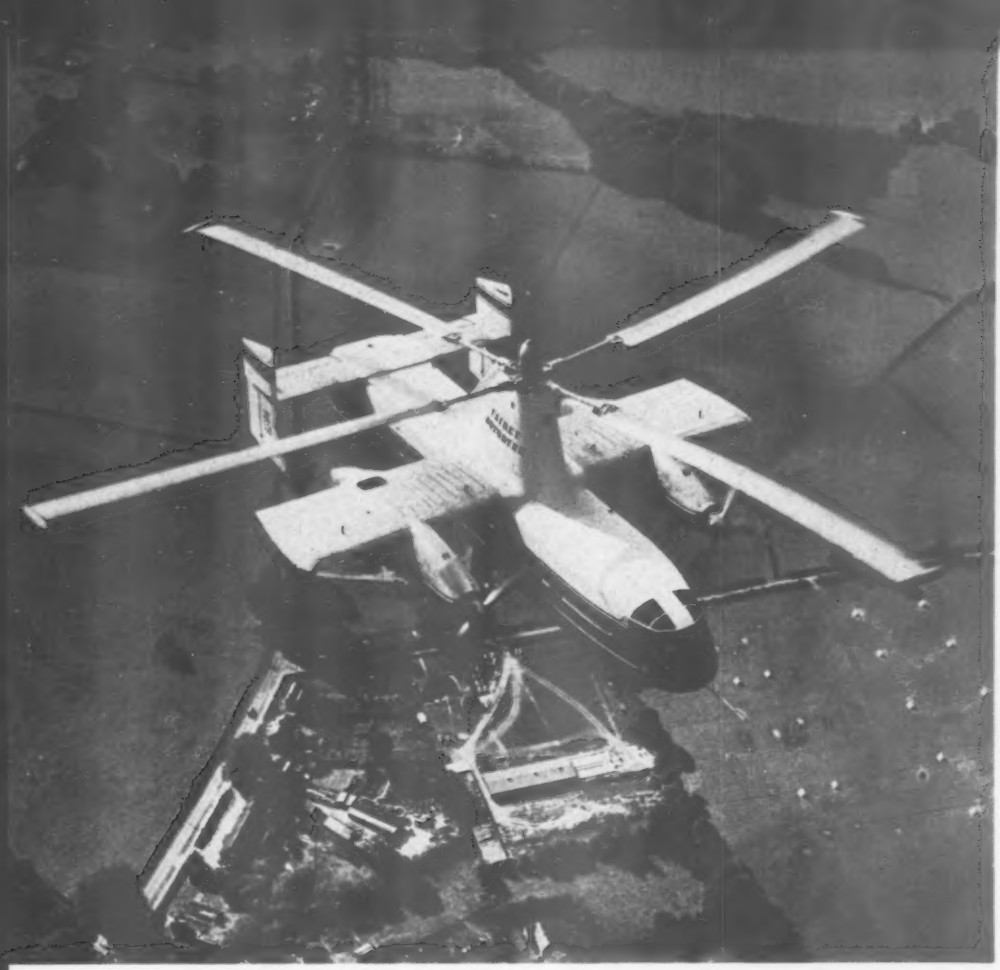
Claude Grahame-White—the Last Tribute

LORD BRABAZON OF TARA, president of the Royal Aero Club, gave the address at a memorial service held for Mr. Claude Grahame-White on Wednesday, September 16, at Christ Church, Down Street, London, W.1. Prebendary R. F. Wright officiated and the lesson was read by Lord Balfour of Inchrye. The Air Council was represented by Air Vice-Marshal W. P. G. Pretty. In the distinguished congregation were numbered those representing all branches of aviation.

SEABORNE AIRPOWER.—H.M.S. "Victorious," the Royal Navy's most modern aircraft carrier, and flagship of the Aircraft Carrier Squadron, steaming in the Channel on September 17. Note the Type 984 "three-dimensional" radar scanner.

Photograph copyright "The Aeroplane and Astronautics"





CRUISING TRANSPORT.—This recent study of the Fairey Rotodyne cruising over the countryside shows to advantage the sturdy lines of the World's first VTOL transport. Recently, the Rotodyne demonstrated its weight-lifting ability by raising an 8,000-lb. external load.

Photograph copyright "The Aeroplane and Astronautics"

Swelling the Group's Resources

FOLLAND Aircraft has become part of the Hawker Siddeley Group following more than 90% acceptances of the offer made by Hawker Siddeley to Folland shareholders. The offer has now become unconditional.

Folland has joined Hawker Aircraft, A. V. Roe, Gloster and Armstrong Whitworth as operating companies of Hawker Siddeley Aviation, Ltd., the overall administration of which is centred at the Group's head office.

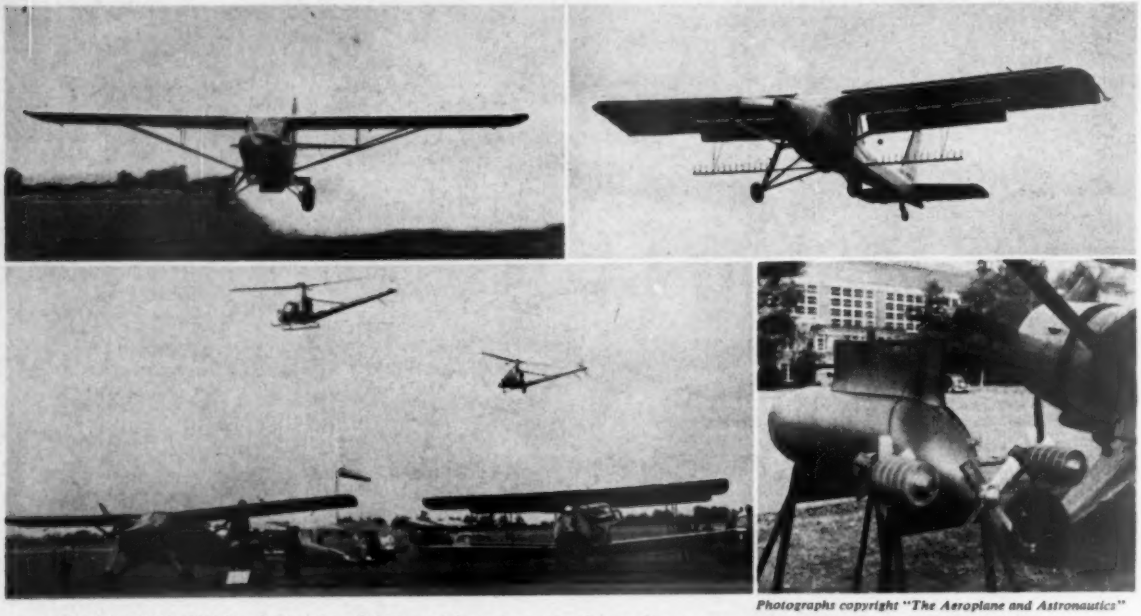
Commenting on the take-over, Sir Roy Dobson, managing director of the Group, said: "We believe this move is in the best interests of all concerned. The Folland company has won for itself a respected place in British aviation and there is a natural affinity between Folland and Hawker in the field of fighter aircraft. In the strength of Hawker Siddeley, with its vast technical and research facilities, as well as its finance and sales resources, the future of Folland can best be assured. Within the Hawker Siddeley Group there should be ample opportunity for Folland's research and technical teams, together with the large body of workers who have contributed to the good name of the company."

Lunik Findings

FIRST details of the findings of Lunik II before it impacted on the Moon were given by the Russians on September 20. According to *Tass*, the Russian news agency, preliminary data obtained so far indicated that no magnetic field had been found in the vicinity of the Moon, nor was there any evidence of a radiation belt composed of charged particles.

Throughout the flight of the instrument container, measurements were made of a number of physical properties, including the "total flux of cosmic radiation, the fluxes of helium nuclei (alpha particles), the carbon, nitrogen, oxygen, and still heavier nuclei forming part of cosmic rays. Additional information was obtained of X-rays, gamma rays, electrons of high and low energies, and high energy particles." Further measurements were made within the Earth's radiation belts. A recording was made of currents generated by ionized gas particles which penetrated from the surrounding medium into the four ion traps installed in the container; and finally, "new data on micro-meteors" were obtained.

The impact area of the instrument container is given as about 497 miles from the centre of the Moon's visible surface, near the craters of Aristillus, Archimedes and Putolyces. At the moment of impact, the container was travelling at 2.05 miles/sec. relative to the Moon and at an angle of 60 degrees to the lunar surface. Processing of tracking information has now shown that both instrument container and final stage rocket landed on the Moon.



Photographs copyright "The Aeroplane and Astronautics"

CRANFIELD'S CROP.—Rounding off last week's very successful conference on agricultural aviation at Cranfield was an extensive flight demonstration of aerial spraying and dusting. Demonstrations included the Auster Workmaster (top left) in both dusting (illustrated) and spraying configurations, and the Czech L60 Brigadyr, making its initial appearance in this country. Bottom left, a Hiller UH-12C and a UH-12A airborne above a Jackaroo Mk. 2 and a D.H. Beaver. Bottom right, a special Spraypack developed for the Beaver and other aircraft by Britten-Norman Ltd.; it is a self-contained unit and distributes 75 gal. of insecticide through two Micronair rotary atomizers. One is carried under each wing.

A Missiles Appointment

MR. A. N. CHRISTMAS has been appointed Director of Guided Weapons Research and Development (Techniques) at the Ministry of Supply. He succeeds Mr. J. W. Phillips, who was recently appointed Director of Guided Weapons Research and Development (Ballistics).

Born in 1913, Mr. Christmas was with Cossors between 1930 and 1934, when he joined the British Electrical and Allied Industries Research Association. He was with the radio branch of the G.P.O. at Dollis Hill from 1937 to 1946, and next went to the guided weapons department of R.A.E.

In 1951 he was appointed to the British Joint Services Mission in Washington. Three years later he went to the Armament Research and Development Establishment, Fort Halstead, as a superintendent.

Canada's International Air Show

MOST spectacular of the many events commemorating the 50th Anniversary of Powered Flight in Canada and the R.C.A.F.'s 35th birthday was the Canadian International Air Show in Toronto, September 11 and 12. Held in conjunction with the Canadian National Exhibition (which daily attracts between 110,000 and 310,000 people), the display took place just offshore, over Lake Ontario.

In previous years, the air show's star attraction has always been a foreign team. This would have been unacceptable in this anniversary year, so the Golden Hawks were formed as the R.C.A.F.'s first, full-time aerobatic team since 1931. Commanded by Sqn. Ldr. F. G. Villeneuve the R.C.A.F.'s aerobatic team of six instructors gave a polished demonstration in their Sabre 5s. They have given over 60 displays from coast-to-coast, but may be disbanded due to budget considerations.

The flag was shown by an R.A.F. Vulcan and Victor, part of a four-plane task force commanded by Gp. Capt. J. E. Johnson, C.O. of R.A.F. Cottesmore. Their low-level passes and the Victor's rate of climb excited considerable interest.

After refusing invitations for three or four years, the Russians sent a Tu-104B, which proved quieter than expected.

De Havilland's Caribou, to be handed over to the U.S. Army on October 8 as the YAC-1, made its first public appearance.

The USAF Thunderbirds wound up the display with traditional élan and near-flawless formations.

Sputnik 3 Leaves a Trail

AT Kiruna Geophysical Observatory in Sweden, Ludwik Liszka noticed that sudden fadings or enhancements of the strength of signals from Sputnik 3 satellite corresponded to definite points in its orbit, and investigation soon showed that these were the points at which it crossed its previous path. Whenever it passed above the track of any one of its previous four revolutions at a time signals were being received, the

PUBLIC INTEREST.—Visitors at Biggin Hill for the Battle of Britain celebrations on Saturday, Sept. 19. Total number of visitors to all R.A.F. stations was 1,067,750.

Photograph copyright "The Aeroplane and Astronautics"

strength suddenly dropped, whereas when it passed below the tracks of the 9th to 13th previous revolutions, along which it had travelled 15 to 23.3 hours earlier, its signals grew stronger.

The only plausible explanation, Mr. Liszka says in a communication to *Nature*, is that the satellite produces a heavily ionized track, although its height at the time of these observations was always above 700 km. (435 miles). This, by the way, is beyond the usually accepted boundary of the ionosphere. It is surprising that the ionization should last for at least a whole day, which is a very long lifetime by physicists' standards.

A further observation by Mr. Liszka is that these signal fluctuations are reduced in intensity by solar flares. The reduction is noticed about a day later, when corpuscles from the flare have had time to reach the Earth's neighbourhood.—A.E.S.

Aviation Art at Guildhall

AIR MARSHAL SIR EDMUND C. HUDLESTON, K.C.B., C.B.E., Vice-Chief of the Air Staff, was to open the 6th Annual Exhibition of the Society of Aviation Artists at Guildhall, London, on Sept. 22 at 15.00 hrs.

This year there is a special R.A.F. section which includes 39 paintings by members of Bomber, Fighter, Coastal, Transport, Flying Training, Technical Training, Maintenance and Signals Commands; the Middle East Air Force, R.A.F. Germany and R.A.F. Malta.

Admission to the exhibition is free. It is open from 10.00 hrs. to 12.00 hrs. daily including Saturdays, but not on Sundays. The Exhibition closes on October 10.

Concentrating Aeronautical Authority

IN present circumstances it is not really very strange that reaction has not been more conspicuous to the publication by the S.B.A.C. of its "Six Points." Appearing just after the successful Russian shot at the Moon and on the eve of Mr. Kruschev's visit to the United States, the statement was overshadowed by the march of events. Moreover, nearer home its publication coincided with preparations for the Election and in the political manœuvrings now taking place, affairs of the Aircraft Industry have not so far taken a conspicuous part.

Before studying the six points themselves it might be profitable to consider the implications of the phrase "Focus of Authority." This is used at the conclusion of the statement where the opinion of the Council of the S.B.A.C. is given that implementation of the measures called for in the six points will require, within the structure of Government administration, a focus of authority empowered to formulate positive, forward-looking national policies and programmes, and provided with the means of securing their execution. In such a context "focus" could bear more than one meaning.

From its optical associations "focus" could convey the idea of a point through which converging rays are passed in order to be brought to bear on some specific object. It is true that one of the handicaps under which the Aircraft Industry has long suffered is the variety of Government agencies which have a say in planning and the placing of orders. But to attempt to make all the activities of such agencies pass through one administrative centre might be to create a bottleneck to surpass all bottlenecks.

On the other hand, if as the statement says the purpose and object of the "Focus of Authority" should be to formulate positive, forward-looking national policies and programmes, then "focus" would seem to convey the idea of a source, a concentration of authority, whence would come unified direction and instruction and planning. And it is devoutly to be hoped would thereby ensure the abolition of the bandying from department to department of requirements and projects. It is interesting to note that the official S.B.A.C. statement points out that the Society has specifically refrained from formulating any definite ideas regarding the form which this focus of authority might take. It goes so far, however, as to suggest that if Departmental terms of reference were revised no radical change of structure would be needed.

Yet it would seem that if forward-looking policies are to be planned some body needs to be brought into being with the means of studying future potentialities, both in the military and civil fields of aeronautics and astronautics, assessing their worth to the national economy and in consequence, the desirability of providing for their implementation and laying the burden of their development upon the Aircraft Industry. There are those who, with such thoughts in mind, believe that something like the U.S. National Aeronautical and Space Agency is required here. It is interesting that no mention of the problems of spaceflight is made in this S.B.A.C. document, yet it would seem that the Aircraft Industry of this country is specifically suited for development work in this exciting and potentially rewarding field. It has all the attraction for the rising generation that what we might call steam aviation had for the engineering generation now at the helm.

This brings us to another aspect of the "Focus of Authority": if its views are to be capable of implementation it must have authority to spend money. And for some of the objects on which it could be expected to plan activity there will be no direct and immediate military requirement. It is for such reasons that we proposed recently that as a country we should get into the way of allocating some proportion of the gross national income to be ploughed back into research. Thus money for aeronautical research and development would no longer come entirely from Service votes but from a specific fund created by annually ploughing back part of the gross national income.

One has only to look at the very remarkable contribution made by the Aircraft Industry in the export market over the past few years to see how profitable have been the moneys allocated to research and development 10 years ago. It is the cessation of spending on that past scale in the fields of aeronautical research and development today which cannot but be reflected in a sizeable reduction of effort in the export market in the years ahead.

These are views which are undoubtedly hard to sell to the nation as a whole and it is for this reason that the time for setting up the tribunal so long advocated by Sir Roy Fedden may now be upon us. Many will remember that 12 years ago the then President of the United States set up the Finletter Commission. The report produced by that body in five months has since become an aviation classic with the title "Survival in the Air Age."

A notable aspect of this body of five was its lack of collective experience in aviation which no doubt ensured its impartiality and, in consequence, the acceptance of its findings by the American nation as being without bias. It was served by an extremely well organized secretariat and to the smooth working of this secretarial organization must be attributed the successful outcome. It may well be that in order to secure for the proposed "Focus of Authority" the necessary national status some impartial and quickly working investigatory commission is a first necessity. It must be ensured, however, that if such a body be appointed it must be so constituted and backed secretarially that results shall be quickly forthcoming.

There will be those who, reading the S.B.A.C. statement, give voice to their impression that the Industry places its needs above those whom it is constituted to serve, the operators of aeroplanes and kindred products in military and civil aviation alike. This of course is not true, but the Industry cannot but be conscious of its special skills and know-how which it has developed to meet the rigorous demands of aeronautics. It is a matter of observation that such knowledge has done much to fertilize development and improve techniques in associated fields of engineering. In other words, without a lively, progressive, and busily occupied Aircraft Industry British engineering as a whole would be technologically the poorer. And this fact has an important bearing on the need for ploughing back into aeronautical research and development a proper proportion of the gross national income.

THE SIX POINTS

Measures to harmonize the transport aircraft requirements of the Services, the airlines, and other potential markets at home, in the Commonwealth and elsewhere.

Measures to expand the volume of the home market.

Measures to make full use of the State airlines and the Services for operational development and proving of new aircraft, engines and equipment, including items which are not the specific requirements of those operators but have other potential markets.

Improved measures to facilitate sales abroad.

Measures to expedite a specific programme of technical advance.

Measures to ensure a continued leading place for British aviation through defined means of Government financial support.

Astronautics and Missile News

ATLAS AGAIN.—On September 17 an operational-type Atlas ICBM was successfully launched from Cape Canaveral over 5,500 miles.

TRANSIT I.—A Thor-Able, launched from Cape Canaveral on September 17, failed to orbit a new satellite, Transit I, when the third stage did not ignite. Designed to enter a nearly circular orbit at 400 miles, the 36-in. diameter satellite was intended to test a new all-weather navigational system for ships and aircraft. It carried two radio transmitters energized by solar cells.

VANGUARD III.—The last of the Vanguard rockets successfully established a 50-lb. satellite in orbit on September 18. With a perigee of 315 miles and an apogee of 2,300 miles, the vehicle is expected to remain in orbit for 30 to 40 years. Principal object is to measure the Earth's magnetic field and "to locate pockets of radiation which may be dangerous to manned space craft." Study is also being made of micrometeorite impacts, solar X-rays, and internal and external temperatures. Radio transmitters, working on silver zinc batteries, will have a lifetime of two to three months. Eleven Vanguard launching attempts have been made over the past 21 months, three of which have been successful.

JUPITER ABORTS. — A Jupiter IRBM carrying frogs, specimens of human blood and skin, and 14 pregnant mice, was exploded by the range safety officer when the rocket developed a control fault shortly after take-off. The biological specimens in the nose-cone were to have been recovered from the Atlantic about 1,500 miles down range from Cape Canaveral.

ATLAS RECOVERY.—Attempts to recover the Atlas boosters for the Mercury space-capsule programme are expected towards the end of the year. Parachute recovery techniques will be used.

OPERATIONAL MACE. — The TM-76A Mace SSM is now operational with the U.S.A.F. in Europe and is replacing the Matador SSM. The range of the Mace is more than 600 naut. miles; it has a self-contained map-matching guidance system known as ATRAN (automatic terrain recognition and navigation). An improved Mace, the TM-76B, is under development. It will have inertial guidance and a range at high altitude of 1,200 naut. miles.

AUSTRALIAN SPACE PLAN.—An Australian National Committee on Space Research has been formed to co-ordinate the national space programme with similar activities overseas.

SPACE PHOTO.—A camera in the nose-cone of an Atlas ICBM has photographed one-sixth of the Earth's surface from a record altitude of 700 miles. The pictures were obtained on 16-mm. film during a 5,100-mile firing from Cape Canaveral on August 24. Chief objective was to check the nose-cone's stability under re-entry conditions.

SWEDISH BLOODHOUND. — The U.K. has loaned a Bristol/Ferranti Bloodhound SAM, together with a quantity of handling and servicing equipment, to the R. Swedish A.F. It will be used by the Swedish armed forces for introductory training prior to the main delivery which is now on order. The equipment was transported to Sweden in two Beverleys.

General Aviation News

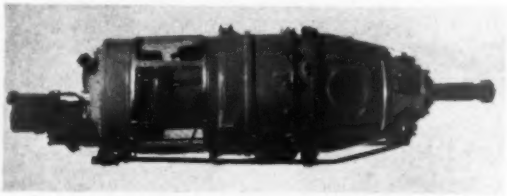
LINCOLNS SCRAPPED. — Three of the few surviving Avro Lincolns in Britain were sold for scrap at Tollerton Aerodrome recently, for a total of £2,975. One had previously been converted for meat-carrying in South America, but this project fell through before delivery of the aircraft and the other two Lincolns remained unconverted.

MOVING SCHOOL. — The A.S.T. School of Aeronautical Engineering at Hamble is to be moved to one of Airwork's training bases — probably Perth—when the new College of Air Training for pilots is established at Hamble next May. The re-formed engineering school will be known as Airwork Services Training to preserve the familiar A.S.T. initials.

HELICOPTER TRAINER. — Hiller Aircraft Corp. has been given exclusive sales rights for the Bolkow BO 102 Heli-Trainer in the U.S., Canada, Mexico and Central America.

CANADIAN TURBOSHAFT. — Canadian Pratt & Whitney Aircraft are developing a 500-e.h.p. reverse-flow free-turbine engine, the PT 6, for light aircraft and helicopters. As a turboprop engine it will weigh 250 lb. and as a turboshaft 225 lb. Its guaranteed maximum s.f.c. is 0.69 lb./e.h.p./hr. Prototype flight engines will be available in 1961.

TURBINE PROJECT.—Details of this free-turbine engine which is being developed by Canadian Pratt & Whitney are given on this page.



LAST T-33.—The last Lockheed T-33 jet trainer was recently delivered by Lockheed Aircraft, 5,691 having been produced since 1948. The T-33 is in service with 27 air forces, and more than 27,000 jet pilots have been awarded their wings on the type. In Canada, 650 were built by Canadair, Ltd., and in Japan Kawasaki constructed 210.

HELP AVAILABLE. — Mr. Jack Armstrong, a Douglas engineering test pilot for over 13 years, has formed a company to offer technical assistance to airlines preparing to introduce new jet transports. The company has offices in Los Angeles and Geneva.

HISTORY AT L.A.P.—B.E.A. is to provide temporary accommodation in its new Engineering Base extension for the aircraft in the R.Ae.S. Nash Collection. The hangars are to be used for Vanguards next summer.

NEW SCIENTIFIC SOCIETY. — A Society of Environmental Engineers has been formed to arrange meetings, publications and visits for engineers who develop equipment to withstand shock, vibration and other forms of environmental conditions and for those who are responsible for research in these fields. Its address is 42 Manchester Street, London, W.1. Its next lecture—"The Investigation of Jet-induced Vibration in Aircraft"—will be held at Imperial College at 6 p.m. on November 25.

CEYLON BOUND.—One of the Royal Ceylon Air Force's new Herons at Hatfield recently prior to delivery; with officers of the Royal Ceylon Air Force, on the right is Sqn. Ldr. J. Short.

ADVERTISING AND P.R.—A series of five lectures on advertising and public relations is to be held at the Royal Festival Hall by the Junior Chamber of Commerce for London. Their dates and titles are: November 3, "Is Advertising a Good Thing?"; November 10, "The Economics of Advertising"; November 17, "Media and Market"; November 24, "Public Relations"; and December 1, "What Does the Consumer Think?" The lectures are to be held at 18.15 hrs. Further information is available from Mr. Alan A. Martin, B.E.A. route sales superintendent, telephone WHItehall 8821.

Commercial Aviation Affairs

B.O.A.C. AND DOPPLER.—Three of B.O.A.C.'s Comet 4s are to be equipped with Marconi AD 2300 series Doppler navigators, continuing the programme of evaluation which has been proceeding for some time with a Britannia 312. A number of international airlines are now assessing the operational effectiveness of various Doppler systems developed for civil use.

CARAVELLE FOR BRAZIL.—The first of two Caravelles for Varig, the Brazilian operator, was handed over to a Varig crew on September 15 at Toulouse.

SAFETY SEMINAR. — The Flight Safety Foundation will hold its 12th Annual International Air Safety Seminar in Nice from October 25 to 29. Speakers are expected to include Dr. J. L. Goddard (FAA), Dr. G. Bennett (B.O.A.C.), H. Caplan (British Aviation Insurance Co.) and R. H. Warde (Bristol Aircraft).

NEW FERRY.—On October 5, Silver City Airways will open a car and passenger ferry service between Jersey and Cherbourg, with connecting flights at Cherbourg for Bournemouth. The service will operate on three days a week.

HELICOPTIMISTS. — Earlier this month, Sabena carried its 250,000th helicopter passenger. This total has been achieved in nine years of operation; it took Sabena 21 years, from 1923 to 1944, to total a quarter of a million passengers on its fixed-wing services.

SAFETY RECORD.—F.A.A. statistics for the U.S. scheduled airline industry show that the passenger fatality rate per 100 million revenue passenger miles fell to 0.44 in the year ending August 31, 1959, compared with 0.54 in the previous year. The number of passenger fatalities was 151 compared with 171 the year before. Biggest reduction was in domestic operations—a fall from 0.49 to 0.33.

FIRST FREIGHTER.—Latest photograph of the Canadair CL-44 shows it with its Rolls-Royce Tynes installed and de Havilland airscrews fitted; first flight is scheduled for November.

T.W.A. JETS TO LONDON.—Trans World Airlines will introduce Boeing 707-320s on their New York—London—Frankfurt service on November 23. There will be three flights a week in each direction initially, and a service from New York to Paris and Rome will begin on December 3. Accommodation in the 707s will be for 32 first-class and 102 economy class passengers.

WINTER RAIL-AIR.—Silver City's rail-air services to and from Paris are to operate this year for the first time throughout the winter on a daily return basis. As from October 4 the London-Paris travelling time will be reduced to a little over six hours.

KINGSTON INTERNATIONAL.—The new runway at Palisadoes Airport, Kingston, Jamaica, was opened for use last month. This 7,600-ft. runway, to international standards, is the result of a major dredged-fill engineering operation, completed more than three years ago, in Kingston Harbour (see the issue of May 18, 1956). A new terminal building is to be completed next year.

EXCHANGE PROJECT. — Aircraft Exchange announces that it will undertake a World-wide study of the economic utility and marketing of surplus piston-engine aircraft. The object is to determine aircraft needs in developing areas, to establish a market for surplus piston-engine aircraft by showing their usefulness and earning potential, and to encourage financiers to participate in second-hand deals.

News About People

BRYANS APPOINTMENT. — Mr. Athel Bodley Scott, D.F.H., M.I.E.E., has been appointed to the board of Bryans Aeroquipment, Ltd., as technical director. His work covers data measurement, transmission and display, recorders and plotters and the technical supervision of Bryans' test and instrumentation equipment for aviation and general industry.

LOCKHEED IN EUROPE. — Mr. Lloyd Harris, former chief pilot of Lockheed's Georgia Division, has been appointed European sales representative for the company, with headquarters in Paris. He will be concerned with sales and promotion of the Super Hercules, JetStar and other Lockheed products.

BOEING APPOINTMENT. — Mr. George S. Schairer, Boeing's director of research since 1957, has been appointed vice-president, research and development.

MOND REORGANIZATION.—The development branch of the Mond Nickel Co.'s development and research department has recently been reorganized into four divisions under the general managership of Mr. F. Dickinson, who is a director of the company. These—and their managers—are: Ferrous Division, Mr. W. W. Braidwood; Non-Ferrous Division, Mr. J. Hide; Applicational Engineering Division, Dr. A. B. Everest; and General Division (which includes plating, chemical products and nuclear power), Dr. E. C. Rhodes.

F.A.A. APPOINTMENT. — Mr. William E. Jackson has been appointed head of the Development Division of the F.A.A.'s Bureau of Research and Development. He is a rated commercial pilot and was previously in charge of the Electronics Division of the C.A.A.'s Technical Development Center.

PIONEER RETIRES.—Capt. R. F. Caspareuthus retired from his position as East African D.C.A. pilot in September. After flying in the R.F.C. and South African Air Force, he joined Union Airways in 1929 and transferred to Imperial Airways in 1930, in which year he made a record-breaking flight from London to South Africa in a Puss Moth. Upon retiring from B.O.A.C. in 1946 as a senior captain, first class, he formed Caspar Air Charter Ltd., in Nairobi, and he joined the D.C.A. in 1949.

COMPUTER APPOINTMENT.—Mr. C. G. Hutchinson has been appointed general sales manager of the Data Recording Instrument Co., Ltd.—an associate company of International Computers and Tabulators Ltd.

TWENTY-FIVE YEARS.—On August 8 Capt. J. T. Percy completed 25 years as a B.O.A.C. and Imperial Airways captain. He has logged 16,000 hr. and crossed the Atlantic more than 500 times. At present he is Flight Captain (Atlantic) of the Britannia 312 Flight; in October he starts training on Boeing 707s.

HELLERMANN, LTD.—Mr. R. A. Parsons has been appointed managing director of Hellermann, Ltd., in succession to Mr. J. Bowthorpe.

Left, Air Cdre. K. J. Singh has been seconded from the Indian Air Force to become C.A.S. of the Ghana Air Force. Right, Wg. Off. Mary Riddle who has been appointed Senior W.R.A.F. Officer and R.A.F. Welfare Officer in Germany.

Air Transport

Problems for Honolulu

WITH the International Air Transport Association's traffic conferences now in progress in Honolulu, and with a "secrecy" clause in operation, it is not practicable to find hard information about the policies which are likely to be followed by the British representatives—including the all-important little group of independent operators. It may, however, be guessed that attempts will have been made at Ministerial level to ensure that there is no repetition of last year's Battle of Cannes, when the independents resisted, by veto, B.E.A.'s and other proposals which cut across the independent's prospects for a fuller development of inclusive tour operations.

Nevertheless, despite the two Corporations' apparent support for lower fares—and various newspaper statements last week-end continued to assume that the British delegations would press for such overall reductions—nothing has been said by either Corporation to give an indication that there will be any kind of show-down in Honolulu.

In its recently published report, B.E.A. stated quite clearly that it would not press for an overall lowering of European fares, but would try, instead, to obtain support for reductions on certain seasonal and night services. B.O.A.C.'s annual report has not yet been published, but it seems clear from the evidence given before the Select Committee on Nationalized Industries that, if anything, this Corporation considers that fare levels are too low and that it would like increases rather than decreases. In evidence, B.O.A.C. spokesmen said that tourist fares were about right, but that Atlantic economy fares should, to balance the profit budget, be raised by 12% and de luxe fares by 10%.

In evidence before the Select Committee both Corporations insisted that an open-rate situation would produce "anarchy" or "chaos"—but a B.E.A. spokesman was also recorded as saying that "we need not overestimate the price-fixing costs of IATA . . . because they do not fix fares for inclusive tours . . . which we can and do. Our income this coming year [1959] is estimated at nearly £2 million alone for inclusive tours." Which suggests that some kinds of "chaos" might be a good thing for the operators as well as for the prospective travellers.

There have been suggestions that IATA, following the events of the last series of traffic conferences, is beginning to think that the unanimity rule is, as the Select Committee put it, "quite lunatic." At these conferences an American Atlantic all-freight carrier was able to hold up agreement on all passenger fares within Europe and Africa.

Heralds to Australasia

CONTINUING their intensive sales campaign with the Dart Herald, Handley Page are to send two of these aircraft to Australasia and the Far East between now and the end of the year. The aircraft involved will be G-AODF, the second prototype which has already completed 50,000 miles of demonstration flying in Asia, the Middle East and South America; and G-APWA, the first production aircraft, which is about to start its flight trials. Both aircraft are due to appear at the opening ceremony for Wellington's new airport at Rongatai; G-AODF will fly out in easy stages, demonstrating at Auckland and Palmerston on the way, and G-APWA will make a high-speed journey to New Zealand.

After the Rongatai opening, G-AODF will return to Britain, and G-APWA will begin an extensive tour of Australasia. The aircraft will be commanded by Sqn. Ldr. H. G. Hazelden and Mr. John Allam respectively. Demonstration tours of Africa and North America are planned early next year.

The itinerary of the Australasia tour is as follows: Auckland (Oct. 19-21); Palmerston North (Oct. 21-23); Wellington (Oct. 23-27); Christchurch (Oct. 27-29); Nelson (Oct. 29-30); Sydney (Nov. 3-4); Canberra (Nov. 4-7); Melbourne (Nov. 7-12); Sydney (Nov. 12-16); Port Moresby (Nov. 17-20); Lae (Nov. 20-22); Jesselton (Nov. 23-25); Manila (Nov. 25-29); Singapore (and Kuala Lumpur) (Nov. 29-Dec. 3); Djakarta (Dec. 3-5); Saigon (Dec. 6-9); Bangkok (Dec. 9-11); Rangoon (Dec. 11-15).

Boeing 707 Reliability

SOME of the recent difficulties experienced with early models of the Boeing 707, and the attendent publicity which, in some quarters of the British national Press, has been rather less than fair, have tended to obscure the aircraft's record of reliability in operation. Some statistics issued by the F.A.A. help to put the teething troubles with undercarriage, hydraulic system and other components into proper perspective.

In the 10 months since Pan American began operations across the Atlantic, its six Boeing 707s have totalled 64,000 engine hours and suffered in that time only five shut-downs. During the 10 months, these six aircraft made 1,273 transatlantic crossings—an average of one crossing every 1.4 days per aircraft; they carried more than 129,000 passengers, compared with about 46,000 by the S.S. "United States" in the same time.

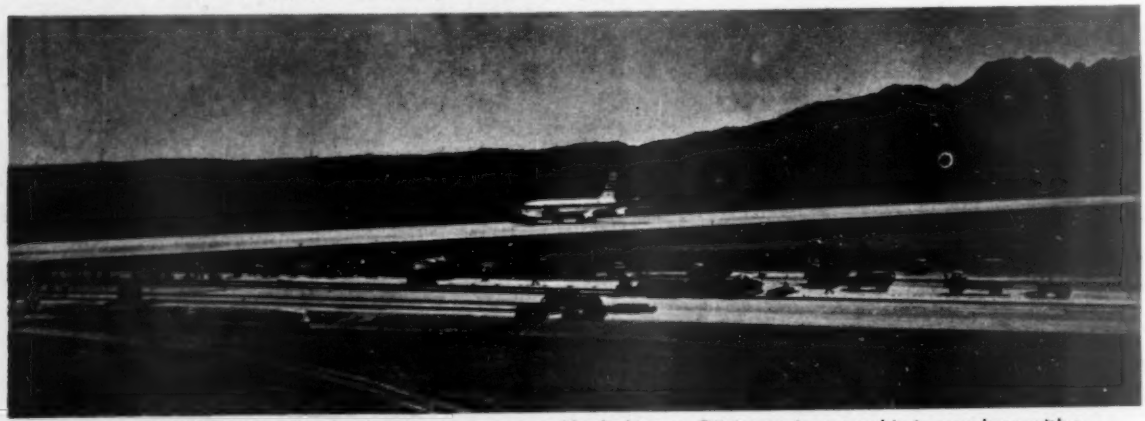
An even better record was achieved by American Airlines, which in five months of domestic operations cancelled only two of 886 scheduled flights by Boeing 707 and completed 48,380 hours with only two engine shut-downs—neither of which required engine removal. Both airlines, according to the F.A.A., are achieving about nine hours utilization per aircraft a day.

The Brancker Memorial Lecture

THAT we are still in the Stone Age of aeronautical development and that, with the technological tools now within our grasp, we can progress further in the next 10 years than we have in the past 50, was one of the points made on September 14 by Capt. E. V. Rickenbacker, chairman of Eastern Air Lines, when delivering the Institute of Transport's 16th Brancker Memorial Lecture.

In this lecture, which was to have been given in April, Capt. Rickenbacker spoke of the immense power for peace which is available in air transport development. Much could be accomplished, he said, if only 25% of the U.S. aircraft industry's talents and a much smaller fraction of its capital resources and statesmanship were devoted to breaking the industrial, financial and political shackles which bind air transport. If part of that fraction of the defence budget could be devoted to the building of civil airports there would be an immense stimulus to commerce.

For the future, Capt. Rickenbacker visualized, beyond the 2,500 m.p.h. supersonic transports, nuclear-powered hypersonic aircraft, long-haul and short-haul, bringing air transport down to a cost within the reach of everyone. To prepare for future inter-city operations all towns of any size would need to zone building heights and bridge the streets to make heliports of adequate size.



PACIFIC PREPARATION.—The developed main runway at Nandi Airport, Fiji, is now in use and it is seen here with a Qantas Boeing 707 taxi-ing out for take-off. The old 6,700-ft. runway has been strengthened and extended to 10,400 ft. and a new control tower built in less than 12 months. The remaining work, including that on the secondary runway, will be completed early in 1960.

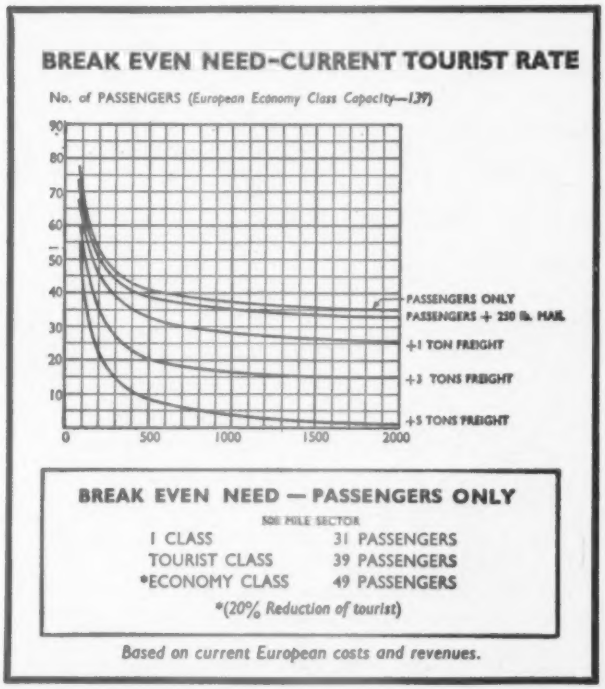
Only the VANGUARD

has this low-cost story

THE CONCLUSIONS to be drawn from this simple graph are among the most significant ever put to airline operators. It shows at a glance that the Vickers Vanguard will break even on total costs (indirect costs are taken as 100 per cent of direct) with passenger loads no higher than those actually carried by Viscounts today.

With three tons of freight the passenger break even requirement can be as low as 21 people falling to only 8 passengers when five tons of freight is carried for 500 miles. The Vanguard is a profitable aircraft on today's payloads yet it has room for the inevitable expansion of traffic which, even at a modest progress, makes the Vanguard the biggest potential money earner ever built.

In addition to its outstanding economy, the Vanguard is fully competitive in speed (425 m.p.h. cruise), and its turbo-prop flexibility will enable it to maintain schedules as good as any, while allowing for realistic traffic conditions.



Based on current European costs and revenues.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 10 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT634

D

WEAVER

dig deep

The juice is a long way down.
It's the same on the big airports now.
AIR BP service runs deep under the surface in the pipelines of new hydrant installations that bring fuel to aircraft without movement of big vehicles. Hydrant fuelling is part of the AIR BP faster-fuelling plan—a concerted attack on time-on-the-ground figures to enable air operators to achieve the last minute of utilisation.

AIR BP

THE AVIATION SERVICE OF BRITISH PETROLEUM

Air Transport . . . .

Facing the New Problems

THE fact that the performance characteristics of the modern turbojet transport have overtaken the available pilots' aids was stressed once again at a recent R.Ae.S. symposium.* Five papers were given on subjects covered by the title "Problems of Take-off and Landing," and most of them pointed to deficiencies of existing control systems, in the air and on the ground. As the airline pilot among the speakers put it: "The contemporary batch of large jets should not be operated with the same old instruments that have been used for years. . . . Yet attempts are being made to do this."

Pending the arrival of pilot-accepted and entirely reliable automatic final approach and landing systems, a great deal can still be done to make the operation safer—particularly during the approach and landing phases—and methods for ensuring this were outlined. The primary difficulties on final approach in poor visibility are concerned with accurate and rapid reorientation after transition from instrument to visual handling and the judgment of relative height during the few seconds of a visual approach following this transition.

A reasonably immediate solution to the second problem can be offered by the visual glidepath indicator, such as that already installed at L.A.P. A great reduction in the transition problems will eventually be possible with the development of the "head-up" flight director—whereby the essential approach information will be provided at normal eye-level, with pictorial indications (such as synthetic approach-lighting patterns), merging, at transition, into the actual, outside indications.

Flight Deck Opinion

Since the pilot has the job of making sense out of, and producing practical results from, all the various devices, it might be as well to start with the comments made by Capt. B. O. Prowse at the symposium. Although he did not say so in so many words, the major point to be remembered is that, though the human brain is a most effective all-round computer, it has the disadvantage of being part of a creature which has a great many other problems on its mind—and the consequent advantage of being able to look beyond the inputs essential to the immediate problem. The designer must always remember the weakness, as well as the strength, of this best of all-round computers.

After outlining the problems and demonstrating the fact that the modern aeroplane is reaching a stage in performance which, with existing aids, is moving beyond the capabilities of its pilot, Capt. Prowse had some vigorous things to say about automatic-landing developments. "To try to persuade pilots to entrust themselves and their passengers to a landing controlled entirely by black boxes . . . is going to be no easy job. . . . I firmly believe that some form of separate-source monitoring of fully automatic landings will be most necessary during its introductory years at least. . . . To fit multiplex auto-channel equipment and try to persuade pilots how unlikely it is to let them down by quoting a probable failure rate of one in so many million landings will be a waste of time and money."

He considered that take-off monitors are essential for large turbojets. The existing method of complying with predetermined V1 and V2 speeds was a crude one; these speeds must be related to time and/or distance.

A Scientist's View

The principal object of Mr. E. S. Calvert's paper was that of drawing attention to the limitations of the best of present-day visual aids. Good though the results of the use of the crossbar approach lighting system had been, it still lacked adequate guidance in the vertical plane. The visual glidepath indicator would help greatly in this matter and the load on the pilot would be still further reduced when the "head-up" flight director came eventually into regular use.

Mr. Calvert explained in detail the elements of visual guidance during the approach and showed why, when visibility is poor, vertical displacements are difficult to judge—and particularly so at a large bank angle and for a few seconds after this had been corrected. The implication, in the use of such terms as "critical height," that "reference to the ground" somehow produces "safety" was no longer necessarily true, and there was no sharp recognizable division between safe and dangerous situations.

Good arguments were offered against the usual procedure in which one pilot (usually the captain) makes both the instrument approach and the visual landing. When using flight-director information comparatively little skill was required and it should be possible for the pilot making the visual landing to be the one who also watched for the approach lights and would take over only when he was satisfied that he had a grip of the visual situation.

Mr. Calvert suggested that, when on GCA, the pilot should give his critical height at the start of the talk-down and that, when the aircraft reached the range corresponding to this height, the controller should say so and thereafter give glidepath information only at, say, one-second intervals.

Pending the development of "head-up" flight directors, training should be supplemented by demonstrations, using films and a simple bad-weather landing simulator, to show the limitations of visual guidance in all conditions.

Automatic Control

In his paper, Mr. E. W. Pike explained that two fully automatic landing systems had now reached an advanced state of development. One, the B.L.E.U. system, has already been adequately described; the other, the U.S. Bell system, as an essentially military (carrier-landing) development, is rather less well known.

Mr. Pike explained how this system employed a highly accurate auto-follow radar and a special ground computer which observed the aircraft's position and flight path within a few miles of the runway. Necessary corrections in azimuth and elevation were calculated continuously and the ILS channel was used for transmitting this data to the aircraft; normal automatic couplings to the autopilot were used to manœuvre the aircraft. The system had the advantage of the ability to handle varied types of aircraft and required no special airborne equipment.

The U.S. Federal Aviation Agency would, early in 1960, be starting experiments in the first phase of a more ambitious automatic landing project which would be capable of employing a very large number of approach paths in order to speed movements and provide greater ATC flexibility. Later in his paper Mr. Pike mentioned that it had been calculated that safe all-weather landing capability in the U.S.A. would be worth about $25 million annually to the civil aviation industry.

Two important aspects of automatic flight were being closely investigated. First, the safety provisions necessary to offset system failure (for example, autopilot runaway) at a late stage of the landing. Multiplexing autopilot channels as a means of overcoming this danger was being studied. Secondly, the requirements for an independent monitoring system had to be determined; pilots were very naturally opposed to placing complete reliance on black boxes unless their performance could be closely watched by means such as a televised picture of the runway or a synthetic visual display in the cockpit.

Mr. Pike expressed the personal conviction that airport authorities would need to give serious thought to the desirability of installing arrester devices at the ends of runways. There was doubt whether a real requirement existed for automatic take-off, but there was a strong demand for improved means of monitoring the take-off performance.

Sensory Confusions

The Australian contribution to the symposium (from Mr. R. W. Cumming and communicated by Mr. L. P. Coombes) dealt primarily with human judgment problems in relation to turbojet equipment, performance and handling techniques. For instance, a classical night take-off problem concerned the sensory confusion between acceleration and climb—a confusion which is accentuated by acceleration effects on the artificial horizon. The development of angle-of-attack indicators was one solution to this problem. The paper also pointed out the marked increase in drag with any drop in speed of jet aircraft after take-off.

Instruments required for the "new family of aircraft" were: an acceleration monitor; a thrust-loss warning system (especially necessary for aircraft with fuselage-mounted engines); and a V1, V2 and take-off-weight computer. For landing, since distances were now more critical, the use of a threshold cut-off speed was required—with a mandatory overshoot if the speed over the fence was in excess of a certain value. This paper, like that of Mr. Pike, recommended the

* Held on September 4 in conjunction with the sixth meeting of the Commonwealth Advisory Aeronautical Research Council in London.

Air Transport . . . .

use of emergency arresting gear. An improved airspeed presentation, for use on the approach, was also required and this might be of the aural type; alternatively, there should be an automatic speed-holding system.

Temperature and Altitude Effects

Not unnaturally the South African contribution, communicated by Dr. A. J. A. Roux, dealt with the effects of high ambient temperatures and terrain elevations on take-off and en-route performance. Approximately 72% of the South African route network lies over terrain between 3,300 ft. and 4,900 ft. a.m.s.l., and 17% lies between 4,900 ft. and 6,600 ft. The general terminus of the network, Jan Smuts, lies at 5,550 ft. and temperatures are high during the summer months.

These natural facts meant that the Union, using U.S. aircraft in the days before full temperature accountability and other factors were introduced into the American code, had to devise its own operational rules. A method which would permit higher and more economical take-off weights was that of "unbalancing" field lengths by using clearways and stopways which were much less expensive to prepare than surfaced runways. Using Windhoek (altitude 5,578 ft. and 85% ambient temperatures rising to I.S.A. +28° C.) as an example, the paper showed how stopways and clearways equivalent in effect to a considerable runway extension could be constructed for a comparatively small sum. The proposed alterations to make the airport suitable for Viscount 810 operation involve an increase of runway length from 6,000 ft. to 7,500 ft. and stopway/clearway additions of 2,000 ft. But, with the introduction of large turbojet aircraft, the aerodrome facilities in South Africa would again need to be revised.

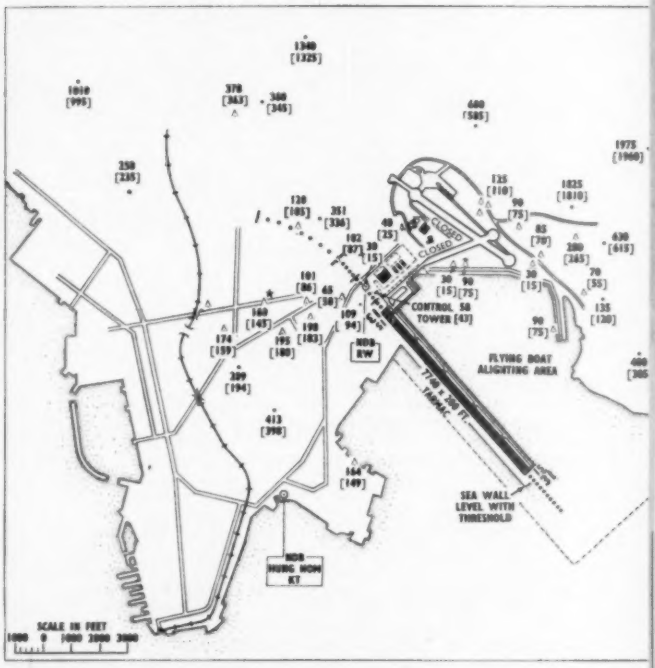
Curved Approach Lighting

THE development of Hong Kong's Kai Tak airport and the flying problems involved in using both the earlier and new runway systems have been interesting subjects during the past three years or more. Articles dealing with Kai Tak were published in the issues of August 2, 1957, and February 20, 1959, and a dramatic air-to-ground photograph appeared in the issue of June 12 this year. Briefly, the major part of the redevelopment work has involved the completion of a new 8,000-ft. runway jutting out into Kowloon Bay.

Because of local high ground, and the Lion Rock Hills in particular, even this new runway cannot be approached in a straight line except from the south-east through the Lei Mun gap between Hong Kong Island and the mainland. So that the airport can be used in each direction throughout 24 hours, therefore, something new in the way of an approach-lighting system had to be devised for approaches from the north-west.

This is a line-and-bar system, installed by the (British) General Electric Company, which is not only curved for the first 3,500 ft. of its length, but is designed so that it can always be seen as a complete pattern by a pilot during his approach over Kowloon. For the south-east approach there is a single centre line of lights supported on piles. As for the old airport, aircraft come in for finals from the north-west over Cheung Chau and Stonecutters Island and, from the south-east, via Waglan Island and the Lei Mun gap. With the new runway, however, it is an unobstructed run-in from the gap. For the more difficult north-west approach there is a flashing location beacon on a hill on the Kowloon peninsula. This beacon is about 4,000 ft. from the crossbar marking the start of the approach lighting.

The 3,510-ft. curved section of this lighting is laid out for a rate one turn at an approach speed of 140 knots (equivalent to a change of heading of 3° per second). From the second crossbar the remaining 2,800 ft. of the lighting is straight and in line with the runway centre-line and there are two more crossbars before reaching the green threshold bar. On the curved section the approach lights are spaced at 438 ft., closing to 200 ft. on the final run-in. So that the complete pattern can be viewed on initial approach, the centre-line and crossbar lighting is arranged as necessary with duplicated, angled and overlapping-beam lamps, one or both series of which can be seen throughout the approach.



The two approach systems and the runway lighting have high- and low-intensity patterns and the two available power circuits are "interleaved" so that each feeds alternate lights. Both systems have high-intensity lights to provide lead-out patterns for take-off, and the low-intensity lights are omni-directional so that they can be used as approach and lead-out lights.

The runway has a dual system of high- and low-intensity lights on elevated frangible mountings except at the intersections. This lighting is white except for the last 2,000 ft., as seen from an approaching aircraft in either direction, which is yellow. High-intensity white wing-bars extend on each side of the green threshhold bars and, for the approach from the south-east, there are two angle-of-approach indicators.

The whole system is controlled from the tower, where there is the usual mimic diagram.

On the left is Kai Tak's runway seen from Kowloon City, with three of the crossbars and the threshold and wing-bar lighting. Lei Mun gap is in the background. The chart above is from the current Aerad Guide and shows the layout of the approach lighting and the high ground (with spot height figures) which makes the pattern necessary.

The Fighting Services

An Air Ministry Appointment

AIR COMMODORE A. CASE, C.B.E., has been appointed Director of Operational Requirements (B) at Air Ministry. Born at Portsmouth in 1916, he was educated in Malta and later attended the Imperial Service College, Windsor. He joined the Royal Air Force in 1934.

In 1936 he went to 202 Squadron, which was then equipped with flying-boats. During 1940 he was an R.A.F. test pilot, making experimental flights with prototype marine aircraft. In 1942 he returned to No. 202 Squadron as its commanding officer. He was appointed an O.B.E. in 1943 and he became a C.B.E. in 1957. On promotion to Group Captain in 1953 he took over command of R.A.F. Chivenor, Devon. From there he went to Cyprus in 1956 where he commanded R.A.F. Station Nicosia, during the height of the troubles in the island. Air Commodore Case has just completed a course at the Imperial Defence College.

F.E.A.F. Squadron Changes

TWO helicopter squadrons—Nos. 155 and 194—have been amalgamated at their base at R.A.F. Kuala Lumpur to form a new single unit—No. 110 Squadron. The former C.O. of No. 194 Squadron, Sqn. Ldr. F. Barnes, has been appointed to command the new Squadron.

During its five years in Malaya No. 155 Squadron has averaged a yearly airlift of some 16,000 troops and 225,000 lb. of supplies in addition to carrying out aeromedical, casualty and other flights. No. 194 Squadron's figures show an average of 2,000 troops airlifted and 125,000 lb. of supplies flown each year.

No. 52 Squadron (Sqn. Ldr. D. G. F. Palmer) has disbanded its headquarters at R.A.F. Changi, Singapore, which has been its base since July, 1947. Only the half of the Squadron at R.A.F. Kuala Lumpur will continue as the remnant of the old Air Supply Force (Malaya), whose functions will now be gradually taken over by the R. Malayan A.F.

As from August 1, Sqn. Ldr. S. R. Dixon, A.F.C., O.C., Air Supply Force, has taken over command of No. 52 Squadron at Kuala Lumpur from Sqn. Ldr. Palmer, who commanded it from February, 1957.

The Air Supply Force formerly comprised detached Valettas and crews of No. 52 Squadron, plus Freighters and crews of No. 41 Squadron, R.N.Z.A.F., which is also based at Changi. No. 41 Squadron aircraft and crews will still operate at Kuala Lumpur on detachment with No. 52 Squadron.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. R. G. Bowditch, C.B.E., to the Department of the Air Member for Supply and Organization; Wg. Cdr. R. A. Seymour, A.F.C., to the Department of the Chief of the Air Staff.

Bomber Command: Gp. Capt. P. P. W. Sands, M.B.E., D.F.C., to R.A.F. North Luffenham to command; Wg. Cdr. B. R. W. Forster, M.B.E., D.F.C., A.F.C. to R.A.F. North Luffenham to command No. 141 Squadron; Sqn. Ldr. J. L. Causton, D.F.C., to the Central Reconnaissance Establishment with the acting rank of Wg. Cdr.

Fighter Command: Wg. Cdr. F. W. M. Jensen, O.B.E., D.F.C., A.F.C., to R.A.F. Martlesham Heath as Group Captain Operations with the acting rank of Gp. Capt.

BATTLE COMMEMORATION.—Air Marshal Sir Geoffrey Tuttle, representing the Air Council, leaves St. Clement Danes after a service commemorating the Battle of Britain. He is accompanied by Mr. G. R. Boak, general secretary of the R.A.F. Association.

Transport Command: Sqn. Ldr. K. R. Richardson, D.F.C., to Christmas Island to command the Administrative Wing, with acting rank of Wg. Cdr.

Flying Training Command: Gp. Capt. K. S. Batchelor, D.F.C., to Headquarters, 23 Group, as Senior Personnel Staff Officer; Wg. Cdr. D. R. Griffiths, D.F.C., to the Joint Cadet Executive, War Office.

Technical Training Command: Wg. Cdr. V. O. Joseph to R.A.F. Cardington as President of the R.A.F. Youth Selection Centre; Wg. Cdr. W. E. Nelson, to be Senior Dental Officer, R.A.F. Bridgnorth.

Maintenance Command: Wg. Cdr. A. P. Dart, D.S.O., D.F.C., to the Directing Staff of the Staff College, Andover.

R.A.F. Germany: Gp. Capt. L. A. Jackson, C.B.E., to the Logistics Division.

Middle East Air Force: Sqn. Ldr. M. R. Sisley, A.F.C., to Headquarters as Deputy Senior Personnel Staff Officer with acting rank of Wg. Cdr.

British Forces Arabian Peninsula: Wg. Cdr. E. M. Poole as Principal Dental Officer.

Far East Air Force: Wg. Cdr. G. W. W. Waddington, D.F.C., to R.A.F. Tengah to command the Flying Wing.

Reunions

No. 612 Squadron.—A reunion will be held in London on November 7, 1959. Details from W. N. Parsons, Wildcroft, Farm Lane, East Horsley, Surrey.

No. 92 Squadron.—A reunion for past and present aircrew will be held at the R.A.F. Club, London, on November 21, 1959. Past members should contact the Squadron Adjutant, R.A.F. Middleton St. George, Darlington, Co. Durham.

TURBINE TRANSPORTS.—A Britannia and a Comet of R.A.F. Transport Command at dispersal at Changi, the R.A.F.'s Singapore base and staging post.

THE AEROPLANE
and ASTRONAUTICS

Solving Icing Problems

AN elegantly finished Lincoln bomber with civil markings displayed at the recent S.B.A.C. Show focused attention on the work of the Napier icing-research unit which is based at Luton. With this aircraft the Napier team has flight-tested and proved airframe ice-protection systems for both the Comet 4 and Britannia.

This specialist unit has studied airframe and engine icing problems since the end of the War and is thus well placed to advise on the design of ice-protection systems for both civil and military aircraft. Moreover, with its specialized equipment, it is able to test these systems in flight.

In point of fact, the unit's facilities are in considerable demand today and its future programme includes anti-icing tests for foreign as well as British aircraft. The modern trend is to prove the ice-protection system of an aircraft before the prototype flies. This can be done by the team at Luton; early testing (which can be accomplished in about 35-50 flying hours using the Lincoln) ensures that the most efficient type of system can be developed and avoids the retrospective—and inevitably expensive—modifications which may be necessary if tests are made at a much later stage using prototype aircraft.

For this work, Napier has, among other equipment, flight-test aircraft and an icing wind-tunnel. These can simulate varied icing conditions at any time; there is no need to delay flight programmes because natural icing conditions cannot be found. Scientifically controlled icing conditions can in fact be produced at will; this avoids the difficulties of measuring the transient conditions of natural icing.

Arbitrary and necessarily severe standards of icing have been laid down by both the British and U.S. airworthiness authorities. These can be simulated by flying a research aircraft in clear air which is at a temperature below 0° C., and spraying an aerofoil surface from the aircraft under test with water droplets.

The Lincoln that is used for this work has been specially equipped to test aerofoils from aircraft with either electrical, hot-air or mechanical ice-protection systems. The section investigated is usually a full-scale wing or tailplane tip; typical dimensions are about 9 ft. chord and 7 ft. span. This specimen is mounted vertically above the Lincoln's fuselage and is pivoted on a vertical axis to move through an incidence range of about 17°.

Ahead of the test aerofoil is a spray grid supplied with water under pressure—for which purpose 200 gal. of water is carried in bomb-bay tanks. A Blackburn Palouste air compressor is also mounted in the Lincoln's bomb-bay and supplies compressed air for blast atomization at the spray nozzles.

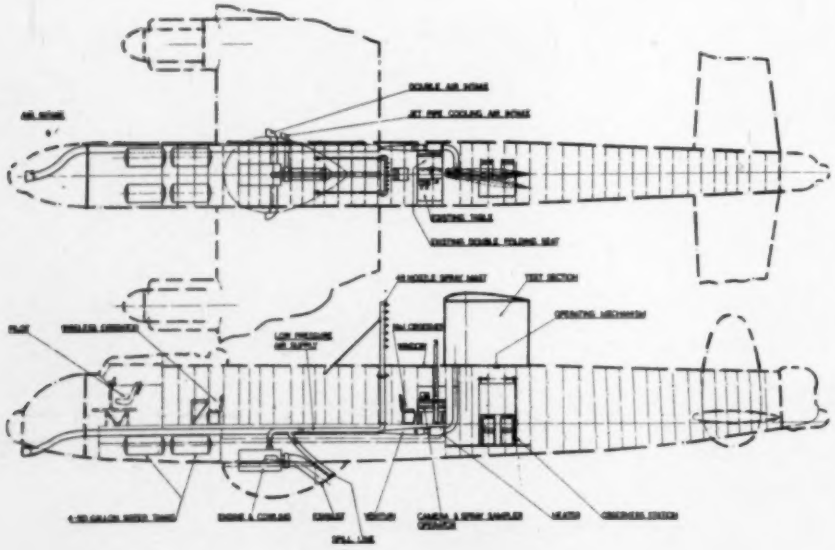
If a hot-air anti-icing system is under test, it is supplied by air taken from the Palouste air compressor and passed through electrical heaters which can dissipate up to 70 kVA. of power. For electrical systems, up to 80 kVA. can be provided.

A range of conditions must be met to simulate the required icing conditions. Altitude, airspeed, temperature and ice distribution can easily be measured using standard instruments. Other important factors are droplet size and distribution, and the attitude of the test section.

Specially developed spray nozzles produce droplets of the required size. Their size and distribution can be checked in flight using a sampling technique in which the drops strike an oil-covered glass slide.

Pressure points are normally incorporated in the test aerofoil so that the pressure distribution can be measured and if necessary the aerofoil incidence can be changed to give the same pressure distribution as on the aircraft being studied.

Napier's extensive past experience in this direction has included icing research programmes for the Ministry of Supply, and anti-icing development tests on the Naiad and Eland engines and Beverley transport. Recent anti-icing tests with the Lincoln included certification programmes on Britannia, Comet 4 and Caravelle aerofoil surfaces. Tests for the Avro 748 and Armstrong Whitworth Argosy are scheduled.



HIGH-ALTITUDE LINCOLN.—Top, in this year's hot summer the unpressurized Lincoln has had to fly at heights up to nearly 27,000 ft. to reach air at —30°C. for icing tests. On the fuselage nose are painted the aerofoil sections from the Beverley, Britannia, Comet 4 and Caravelle which have been tested. A Caravelle section is in position above the fuselage.

Photograph copyright "The Aeroplane and Astronautics"

INTERIOR LAYOUT.—Left, equipment installed in the Lincoln for its icing-research rôle includes a Blackburn Palouste air compressor which supplies air for the spray nozzles ahead of the test aerofoil.

Background to the Britannic

In this article MR. H. G. CONWAY, *M.A., F.R.Ae.S., M.I.Mech.E., deputy managing director and chief engineer of Short Bros. and Harland, Ltd., discusses the design "philosophy" of the Britannic freighter and shows how it fits into the overall pattern of general-purpose aircraft development.*

WE at Shorts first became interested in military freighting in 1954 when, as a result of a survey of future prospects for new types of aircraft, it became obvious that there would be a need eventually to replace the present generation of military freighters represented by the Valetta, Hastings and Beverley. We observed the growth of military freighting in the United States and sent engineers over to study what was happening there on the Packet, the C-130 and C-133 types of aircraft. Activity in France also did not escape our attention.

Our first design was known as the PD.16 and was for an aircraft of about 70,000 lb. all-up weight fitted with two Elands or, later, four Darts. This had a large fuselage whose section was 12 ft. by 10 ft. and had rear loading doors which could be opened in flight for parachute dropping. Our first brochure was completed in December, 1954.

Since that date we have consistently maintained that a fuselage section at least 12 ft. wide by 10 ft. high is an essential feature of any military freighting aircraft. This point of view was formed as a result of surveying military loads, and appreciating the importance of access around loads during loading and, indeed, in flight. In Short's opinion, a 10-ft. fuselage width is not adequate for the military, although no doubt it could be for a purely civil freighter.

In the event we were not able to proceed on a private-venture basis with the PD.16 Freighter. The obvious British need for an aircraft in this category is being met by the later development from another firm.

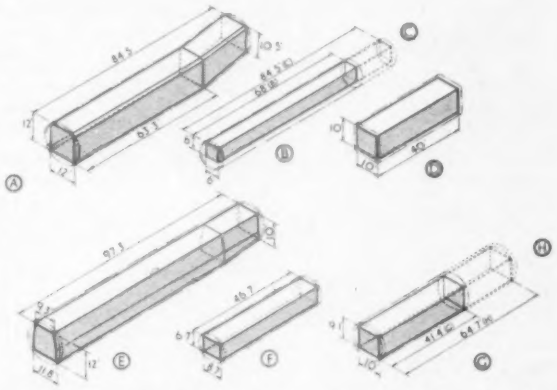


Fig. 2. Comparative fuselage sizes. For description see text.

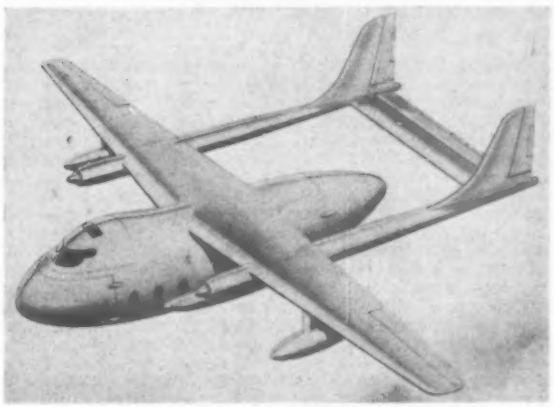


Fig. 1. Short's first step towards the Britannic was their PD.16 twin-boom project of 1954.

The next step was to have a look at what could be done making use of Britannia parts—which were familiar to us as a result of production of Britannias at Belfast and the substantial design contribution we had made in the conversion of the Britannia for R.A.F. needs. We drew up a plan using Britannia components, combining powerplants, wing, tail, undercarriages and systems in various ways, and becoming more ambitious and less Britannia-like as the plan developed.

Initial project work was completed and submitted in brochure form to the Ministry of Supply in March, 1957. Twenty-two months later the acceptance of our proposals by the Minister of Defence was announced in the House of Commons.

Our basic approach has been to design a good fuselage of adequate size for any likely military or civil customer and then to attach it to wings and powerplant installations chosen to suit the various stages in the development plan. As the plan progressed step by step the development cost increased and the performance of the aircraft became better; even jet engines were studied. Indeed, it was up to the customer to "pay his

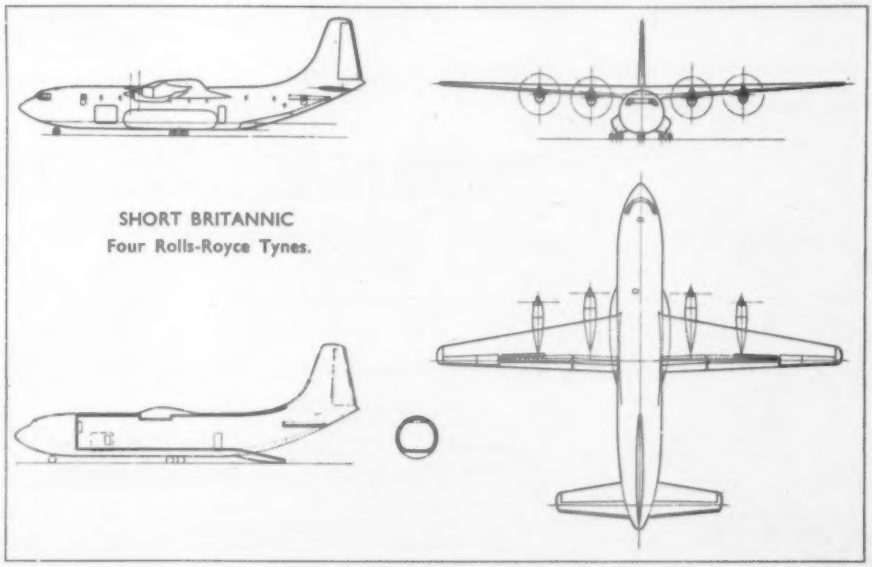


Fig. 3. This general arrangement drawing of the Britannic shows how the special large-capacity fuselage is related to the conventional wing and powerplant layout.

money and take his choice." Throughout, however, we have designed an aircraft suitable both for civil and military markets.

Propeller or Jet?

We are often asked why we choose propeller turbines. There are those who feel that the jet is the modern solution and the propeller turbines are out of date. Some feel that the R.A.F. should have the latest thing and that a jet must be the right answer.

Short's attitude for the past five years has consistently been that the lowest operating cost is more important than speed for military and civil freighting and cheap passenger transport. We are not convinced by arguments that speed in itself is of critical importance to the Royal Air Force or to the Army (who provide the main freight traffic for a military freighter).

Jet speed may be justified on certain specific freight routes (for example, trans-continentally in the U.S.A.), where freight traffic can be guaranteed and the aircraft utilization kept high. This argument does not apply in general to the military sphere nor to the European civil freight potential. Here flexibility is paramount—flexibility meaning good field performance and comparative insensitivity to operating conditions on a variety of routes, both short and long.

A jet aircraft to do the same job as the Britannic would be 30% to 40% larger, and at least a similar amount more expensive. This could mean a unit selling cost of each aircraft of £2.5 million and an enormously greater development expense, which would raise the break-even point well above the 30 aircraft which we believe is the criterion for the Britannic. The Tyne engine already gives the Britannic a speed substantially greater than that of the Viscount, with an extremely low operating cost.

Although our opinions were formed several years ago on this matter, we have been heartened recently to note that all the civil freight orders which have been placed in the U.S.A. this year have been for propeller-driven aircraft.

The detailed Britannic plan developed through the following:
Britannic I and II, 180,000 lb. a.u.w., payload 60,000 lb.
Britannic III, 195,000 lb. a.u.w., payload 75,000 lb.
Britannic IIIA, 218,000 lb. a.u.w., payload 85,000 lb.

The last version is the optimum solution for Royal Air Force needs and combines a large payload potential over short ranges with a considerable potential on the longest R.A.F. stage-lengths around the World.

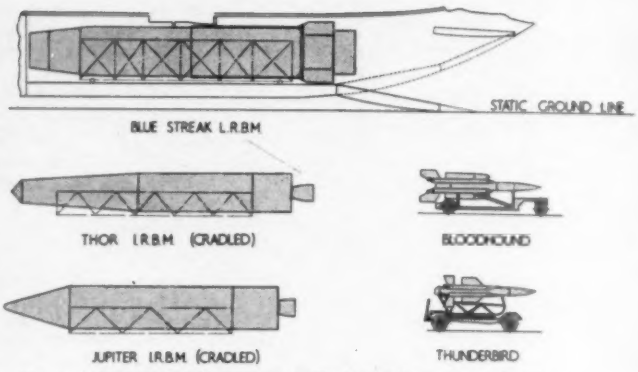


Fig. 5. A Blue Streak long-range ballistic missile accommodated in the hold; other missiles are drawn to scale.

Features of the Britannic

FUSELAGE SIZE. Fig. 2 shows the Britannic fuselage dimensions in relation to other aircraft which we considered in our survey of World freighting needs. Aircraft A is the Britannic whose dimensions are 12 ft. sq. with a central height over most of the fuselage of 13 ft. 9 in. Aircraft B is the Britannia 253, which obviously has a section more suitable for passenger carrying than pure freight. In dotted lines at C is shown the extension on the Canadair CL.44 Freighter now being developed.

Aircraft D is a British tactical aircraft at present in service, while aircraft E is the largest American transport with a cubic volume comparable with the Britannic but rather smaller in cross-section. The differences between these two aircraft give the Britannic a slight advantage when carrying ballistic missiles.

Aircraft F is a new British tactical aircraft similar to the PD.16 project, although of substantially smaller fuselage dimensions. Aircraft G is an American tactical aircraft in use in large numbers, while the dotted extension at H indicates a new civil derivative of this aircraft just announced.

GENERAL ARRANGEMENT. The features which distinguish the Britannic IIIA from previous versions are mainly in the wing layout. Previous versions had used a standard Britannia wing

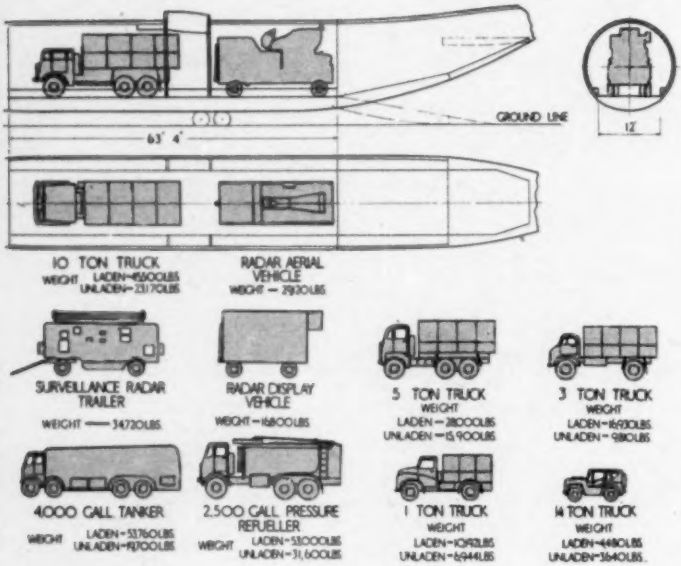


Fig. 4. A variety of military vehicles and the Britannic fuselage drawn to the same scale.

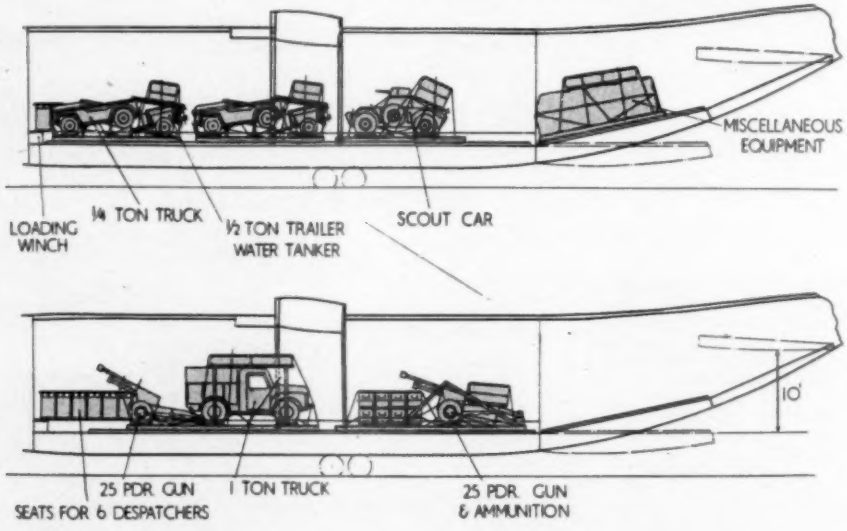
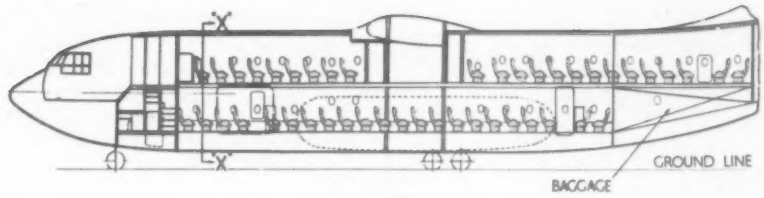
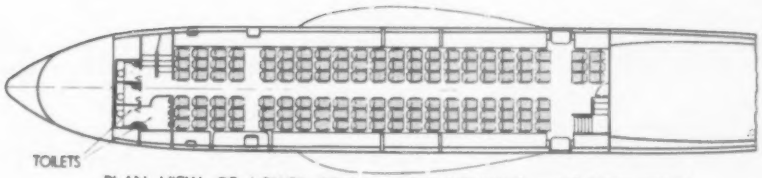


Fig. 6. Typical military loads "palletized" ready for parachute dropping from the rear door of the aircraft.





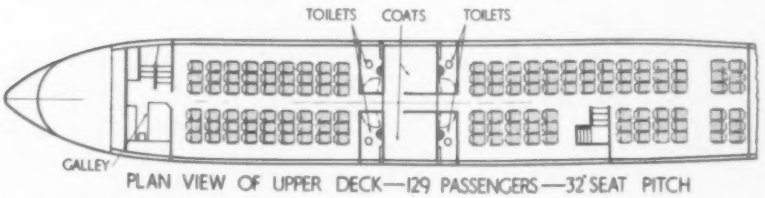


Fig. 7. A removable upper deck over the length of the fuselage enables the Britannic to carry up to 255 passengers in the rôle of a high-density economy-class civil transport.

joined along the aircraft centre-line giving a wing span of about 142 ft.

The present version has a fixed centre-wing section of 16-ft. span attached to the fuselage, the standard Britannia half-wing being attached outboard of the fuselage and giving an additional 16 ft. of wing-span. The outer engine nacelles remain on the present Britannia centres, but the inner nacelles are moved back inwards, spaced equally between the outer engines and the fuselage.

These changes enable the weight to grow from 195,000 lb. on the Britannic III to 218,000 lb. on the Britannic IIIA, keeping the field performance the same (due, of course, to the increased wing area); at the same time, the re-positioning of the inner engine nacelles allows for an increase of propeller size well beyond the 16-ft. units used on the Britannia and on the present Britannic. As the power of the Tyne powerplant grows, the use of an 18-ft. or 20-ft. propeller will give the Britannic a great development potential.

At the same time as these changes were made, the fuel system was revised and integral tanks substituted for the bag tanks of the Britannia 253. This has increased the total fuel content of the aircraft substantially. The disposition of the landing gear was changed as a better method of retracting it was devised, allowing the eight-wheel bogie to follow a spiral course to lie inclined in the blisters without cutting into the fuselage structure proper.

CARRYING CAPACITY. Fig. 4 illustrates typical large military loads which can be disposed inside the fuselage and shows, incidentally, the advantage of the additional height in the rear end of the fuselage. Each of the loads shown is typical of the sort of equipment which the modern Army must be able to carry and illustrates the importance of the fuselage dimensions which have been chosen.

Fig. 5 illustrates the carriage of ballistic missiles and smaller, readily stowed anti-aircraft missiles. Blue Streak is about the limit of carrying capacity of the aircraft and, indeed, can be carried only by the removal of the upper rear door. This door, however, is provided with simple means (built-in) for its removal and slinging to facilitate the process.

The Britannic is also designed for the para-dropping of heavy loads, as illustrated in Fig. 6.

PASSENGER VERSIONS. Although the basic freighter has provision for an upper floor forward of the spar, the aircraft is designed to have this floor extended over the whole fuselage and will enable 255 passengers to be carried in high-density passenger versions (Fig. 7). In Short's opinion (and Short's engineers fly more than most aircraft men), it will not be long before the air passengers object to being squeezed like sardines into the modern high-density aircraft.

We feel that 32-in. seat pitch is acceptable to most passengers, but that 2 in. or 3 in. extra width per seat would make all the difference to comfort. The Britannic offers ample width and a feeling of spaciousness which would make it a popular aircraft with passengers.

Whether airlines will want to fly 250 passengers in one aircraft remains to be seen. We feel, however, that as airline timetable frequency increases, the limit to the number of passengers which can be carried on a given route, or in and out of a given airport, will be determined by the number of aircraft movements which the air traffic control system can handle (particularly in bad weather). For this reason it may be essential to go to bigger units, each carrying more passengers so that the total number of movements can be kept down.

The payload range abilities of the Britannic to the present standard are shown on Fig. 8. It will carry 85,000 lb. over 700 nautical miles with full reserves, or 30,000 lb. over 4,250 n.m. under similar conditions.

This performance compares with the Britannia 253 shown at A, an existing British tactical aircraft at B, the new small

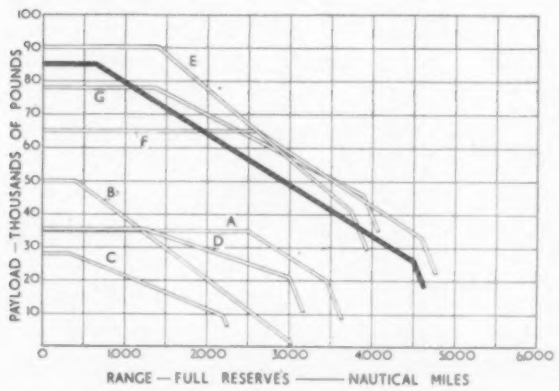


Fig. 8. Payload/range performance curves for the Britannic, to its present standard, and for other contemporary freight carrying aircraft (see text).

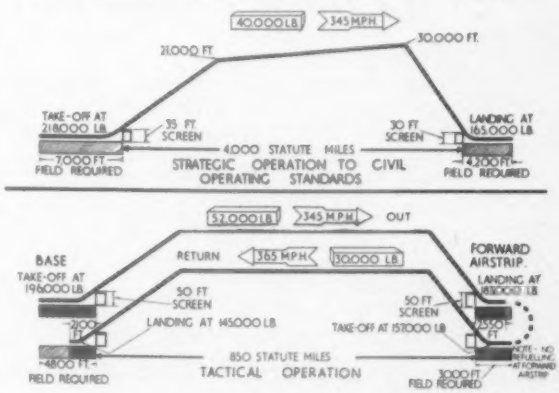


Fig. 10. Typical strategic and tactical operating conditions; the former entailing full-load take-off with a balanced field length of 7,000 ft.

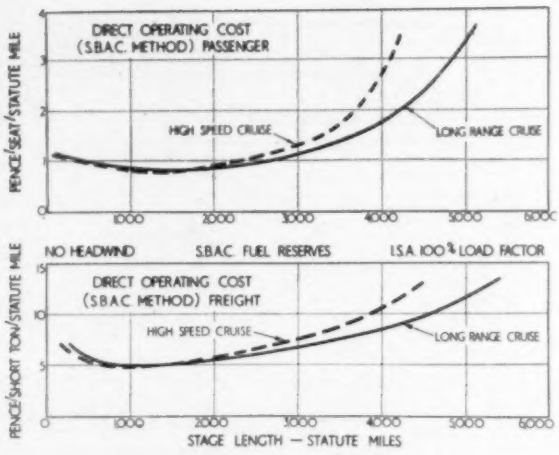


Fig. 11. Cost curves for the Britannic show the comparatively flat characteristic that is considered essential for flexibility of operation—a factor of paramount importance for an aircraft of this type.

British freighter at C, and the standard American tactical freighter at D. The largest American strategic freighter is substantially heavier than the Britannic and carries more (E). The Canadair Freighter CL.44 derived from the Britannia, shown at F, illustrates the first-class performance of this aircraft from the civil freighting point of view (its fuselage is too small for military freighting), and a recently announced American derivative of the aircraft at D is shown at G.

Having regard to the way aircraft are developed with time (F and G are typical), these diagrams will clearly show the development potential ahead of the Britannic and underline Short's claim that it is potentially the largest freighter in the World.

Typical Operations

What the Britannic can do in practical operation is shown in Figs. 9 and 10. Fig. 9 shows what the aircraft can carry for the R.A.F. between London and Australia either with two stops (Aden and Singapore) or five stops (El Adem, Gan, and Darwin). The substantial carrying capacity in either case is clearly shown. In the passenger rôle the aircraft is eminently suitable for such short trips as London to Nice and can also carry 200 passengers or 65,500 lb. of freight on the North Atlantic route.

Fig. 10 illustrates the performance under typical strategic and tactical conditions, the former taking off at full weight with a balanced field length of 7,000 ft. The second diagram shows a typical tactical operation where the aircraft takes off from a 1,600-yd. field, lands in a 1,000-yd. strip, leaving behind 52,000 lb. of load and returning with another 30,000 lb. The return load is determined by the field length available for take-off, in this case assumed to be 1,000 yd., and presupposing that no refuelling takes place at the forward air strip.

Operating Cost

We hesitate to put forward operating-cost figures except as an indication of what can be achieved. Many of the recent published curves for other aircraft have been based upon adapting known standard formulæ to suit the criticisms of the firm in question, and it is not always easy to compare one firm's figures with another impartially.

The curves shown in Fig. 11 are important, however, in that they show the comparatively flat characteristic which we consider is essential to an aircraft claiming flexibility as a principal feature. The figures themselves are extremely low and show a considerable potential, both for passengers and freight.

Civil Potential

We have believed, as a firm, in the future prospects for specialized freighting systems in the civil field for several years. We feel that what has been done by the New Zealand SAFE Airways and Silver City in England and, indeed, by the freighting of new cars into Northern Ireland, are straws in the wind. A survey carried out last year has convinced us that the civil freight potential is enormous if the operating cost can be reduced to about half the present costs. Recent activity in the United States has tended to confirm this opinion.

Development of a freight aircraft in itself is not, however, enough. We must develop a complete freight-handling system fully "palletized" and with special terminal buildings. We are working on this and believe that we will be ready to offer a complete and fully developed low-cost civil freight-handling and aircraft system in a year or two's time.

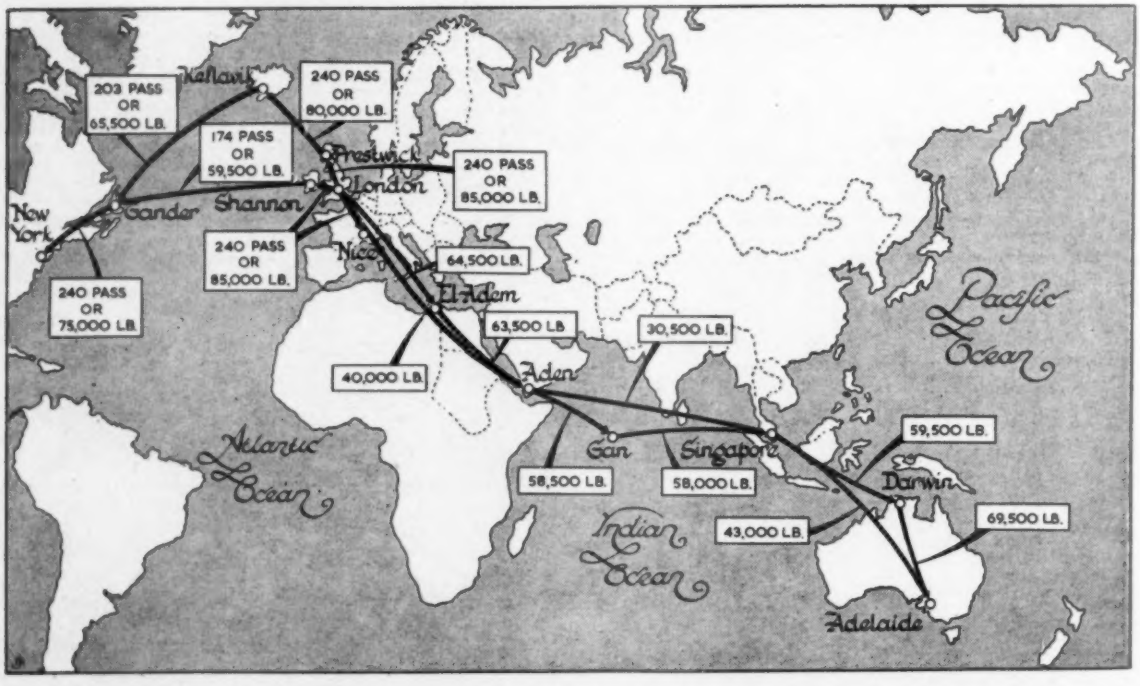


Fig. 9. The Britannic's payload performance over the North Atlantic and on the route to Australia. The figures indicated against the various stages have been based on the assumption of full fuel reserves and 50% annual headwinds.

FOR PASSENGER AND FREIGHT TRANSPORT

THE HANDLEY PAGE HERALD

POWERED BY

ROLLS-ROYCE

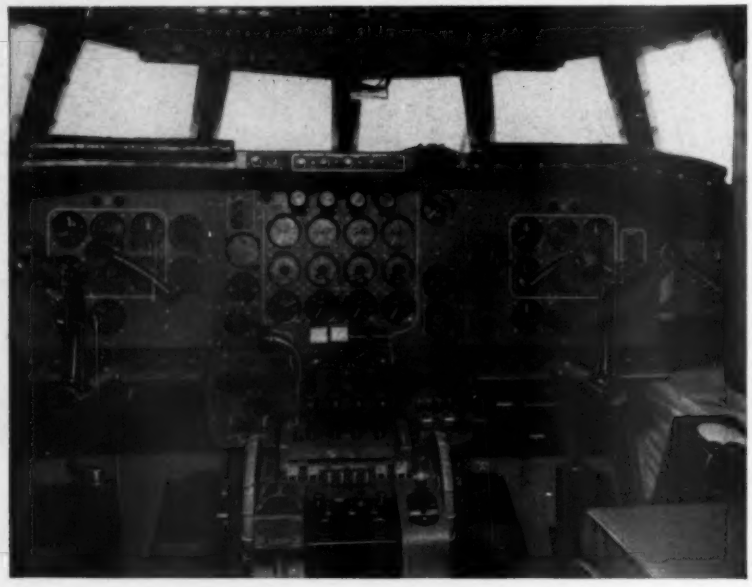
DART PROP-JETS

The Handley Page Herald powered by two Rolls-Royce Dart R.Da.7 prop-jets of 2,105 t.e.h.p. has successfully demonstrated in India and South America its ability to operate from small airfields at high altitudes and in tropical conditions. Dart prop-jets have an unexcelled record of reliability in service and have flown many millions of hours on the air routes of six continents. Darts are in service with overhaul lives of up to 2,400 hours.

ROLLS-ROYCE LIMITED, DERBY, ENGLAND

AERO ENGINES · MOTOR CARS · DIESEL AND PETROL ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION

We have produced
or are producing
FLIGHT SIMULATORS
and **TRAINERS** for
all these famous aircraft



Specialists in the design and manufacture of Flight Simulators

AVON SABRE
BRITANNIA 102, 253, 313 & 314
CANBERRA
CARAVELLE
COMET I, II & IV
CONVAIR 440
DOUGLAS DC7
GANNET
HELICOPTERS
HERCULES (C130)
JAVELIN
SABRE Mk. II, V & VI
STRATOCRUISER
SUPER CONSTELLATION L1049
TRACKER (CS2F)
VALIANT
VANGUARD
VICTOR
VISCOUNT 748, 803, 813 & 814

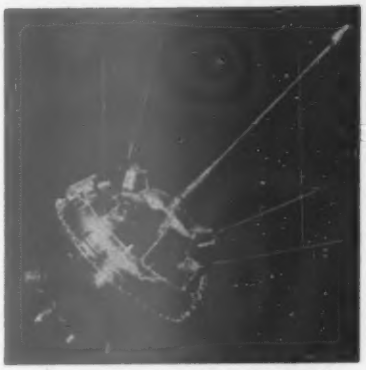
Redifon

REDIFON LIMITED, Flight Simulator Division, Gatwick Road, Crawley, Sussex,
A Manufacturing Company in the Rediffusion Group

Missiles and Astronautics

America's Space Programme

Russia has impacted the Moon: KENNETH GATLAND *discusses what is the present status of U.S. space development*



First round the Sun, Lunik I

Howard Levy photograph

TWO factors contributing to the success of the Russians in impacting the Moon are that they have at their disposal very large multi-stage rockets and a guidance system which ensures a very high order of accuracy. Professor Leonid Sedov, President of the U.S.S.R. Academy of Sciences' Astronomical Council, at a news conference in Moscow on September 14, said that the launching of Lunik II had been successful only because of its "most accurate and dependable automatic equipment. For the rocket to follow the required flight path its boost speed had to be accurate within one metre per second, the angle had to be accurate within one degree, and the launching time had to be accurate to within a few seconds."

In America, reactions to the achievement differed widely. Vice-President Nixon made a vain attempt to calm his countrymen with an assurance that it was a lucky shot made after three earlier attempts had failed, while Dr. Wernher von Braun got down to brass tacks with a statement that America was not spending half enough on space-flight, and at the present rate of progress it would take three years to catch up if the Russians stood still.

Two weeks before Lunik II was fired, Dr. Keith Glennan, administrator of the National Aeronautics and Space Administration, had warned at a Symposium on Ballistic Missiles and Space Technology in Los Angeles, that the U.S. was "not nearly as far advanced in space technology as we had thought or hoped . . . as soon as we began to plan for second generation experiments, we found that we were facing some hard facts of life in the propulsion and guidance fields."

"Even today," Glennan continued, "every shot we make . . . is a shot in which there is little or no margin for even a slight deviation from planned performance parameters. In thrust capability, in guidance—injection, mid-course, terminal—in thrust control, in all these areas, there is much that must be learned and applied before we undertake the difficult missions we all talk about so glibly."

Glennan also criticized the way in which numbers of people in the United States were going around making extravagant predictions concerning the nation's accomplishments in space over the next few years. "It is becoming clear," he said, "that we cannot and should not attempt to undertake all the hundreds of projects that are being recommended to advance our understanding of the space environment. We haven't the manpower, facilities or funds. . . . Probably more than any other single factor, the question that plagues all of us is one of reliability. When will we be able to count on being successful in launching and placing into orbit, or on the desired trajectory in deep space, as many as three out of four of our intended experiments?"

Ironically enough, it is the Army Ballistic Missile Agency at Huntsville, Alabama—the least supported development group—that has accomplished most for America's space effort. Largely composed of ex-German rocket engineers, ABMA is under the technical direction of Dr. Wernher von Braun, co-designer of the V-2 long-range rocket. After the Vanguard had failed in the hands of the U.S. Navy, it was the ABMA team that successfully orbited Explorer I on Jan. 31, 1958, using the well-tried Jupiter-C rocket. Subsequently, when the USAF had made three attempts to orbit the Moon, using Thor-Able, it was again the ex-German group that saved the day, this time with Juno II, which, on March 3, 1959, sent Pioneer IV past the Moon and into orbit around the Sun.

Despite these signal achievements, ABMA has been under pressure for some time to give up space activities. Most of this pressure apparently comes from the Defence Department, where the view has been expressed that the Army group should concentrate on tactical missiles. When NASA was formed last year, it was suggested that the personnel at Alabama should be absorbed into other parts of the space effort, but von Braun and his colleagues have always insisted that the experienced team at ABMA must be kept intact.

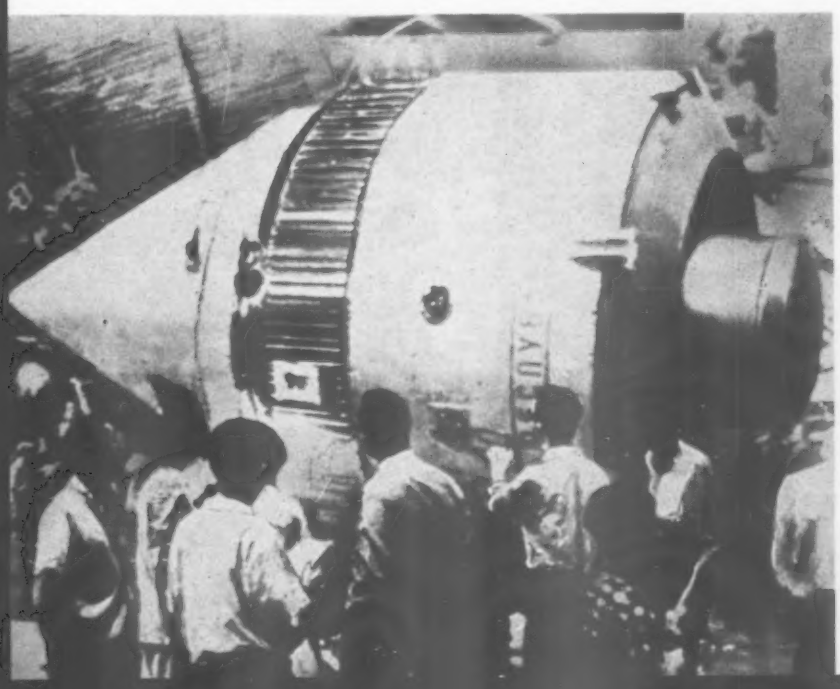
There are as yet no reports that NASA have placed any contracts with ABMA for space development in 1960, although the Advanced Research Projects Agency has the huge Saturn booster under contract with the Army group. Indeed, Saturn seems to be ABMA's trump card, for with the success of Lunik II, increased emphasis must surely be placed on this project to match Soviet achievements which must be expected in the years ahead.

According to present plans, Saturn will weigh about 580 tons at take-off, some 500 tons of which will be accounted for by propellent. The complete vehicle, of three or four stages, will stand nearly 200 ft. high, and will be powered by a cluster of eight Rocketdyne H-1 rocket engines, developing 1.5 million lb. s.t. in its initial stage. This project has been supported by ARPA as a booster for 3,300 lb. 24-hr. communications satellites to be placed in an equatorial orbit at 23,300 miles, but direct support for the vehicle as a booster for lunar space-probes may now be forthcoming.

It will, however, be some time before Saturn can be used in the U.S. space-programme, and meanwhile Atlas will be used increasingly for space - research. According to NASA, a heavily instrumental moon-probe, Able IV, is scheduled for firing from Cape Canaveral on October 3.

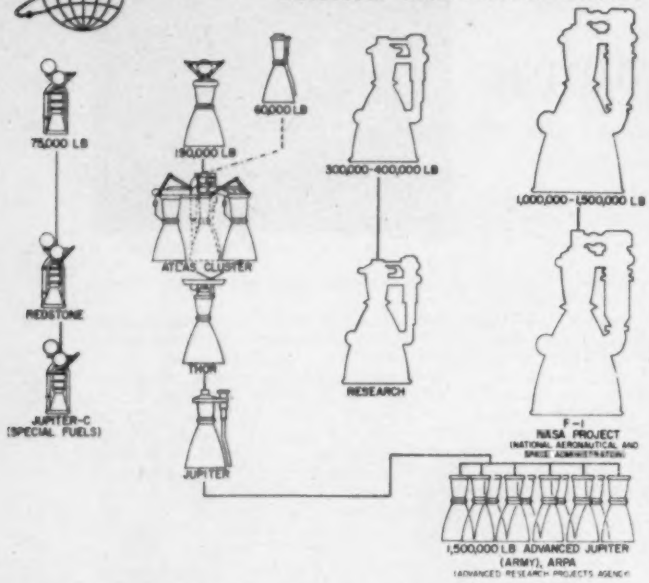
It will be recalled that an attempt was to have been made in June to launch two probe-vehicles, one a Thor-Able, the other an Atlas-Able, in an attempt to intercept the orbit of Venus. The project concerned a so-called "paddle-wheel" satellite, gaining electrical energy for its research instruments directly from sunlight by means of solar cells carried on four extensible vanes. These attempts were cancelled "because of technical difficulties."

A firing was subsequently made of Thor-Able on August 7, which put the U.S.A.F. Explorer VI paddle-wheel satellite into an elliptical orbit round the Earth. The

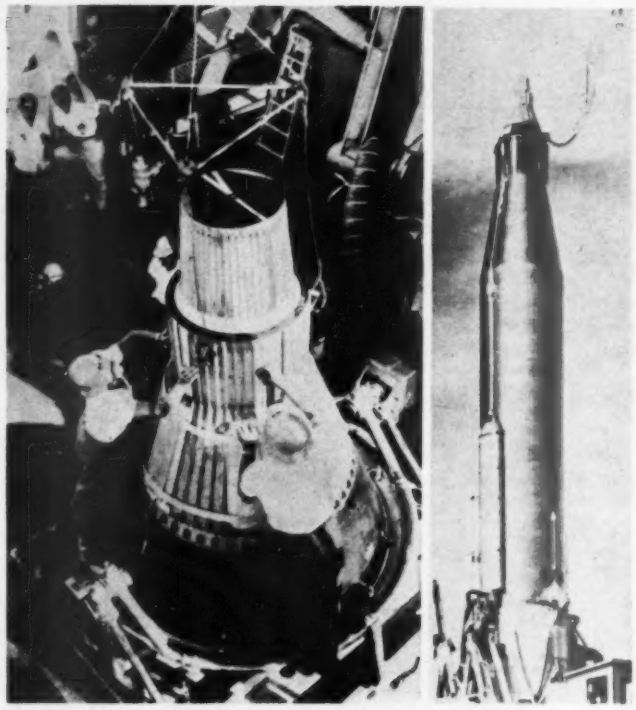


Visitors to the Soviet Exhibition of Science, Technology and Culture in New York had an opportunity of studying this full-scale model of Lunik I's final stage, approximately 20 ft. long by 10 ft. dia.

Missiles and Astronautics



Genealogy of U.S. rocket engines, existing and under development for the projected ARPA Saturn and NASA Nova space-boosters.



Above, (left) final adjustment of Mercury capsule on Atlas booster and (right) the successful launching for the first sub-orbital test on September 9 without human occupant.

forthcoming Atlas-Able is expected to launch a similar satellite package around the Moon.

Beyond Atlas-Able are a number of rocket vehicles, none of which match up to the Soviet rockets in size or thrust, but nevertheless represent a very real contribution to the art and practice of space-research. The first is the Delta rocket, basically the same three-stage configuration as Thor-Able, but with improved inertial guidance and "active control of longer coasting periods between second stage cut-off and third stage ignition." This combination could send a payload of 100 lb. on a deep space mission.

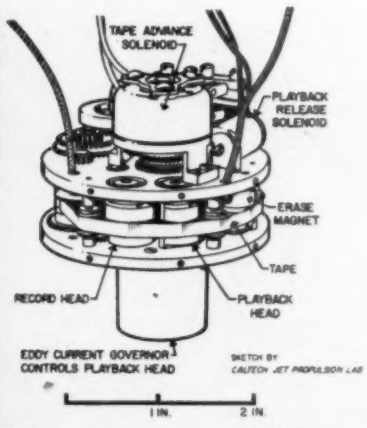
Vega and Centaur are both based on Atlas, but with two additional upper stages. Vega has a modified Vanguard first-stage engine in stage two with a storable liquid-propellent top stage. Estimates suggest it could deposit 730 lb. on the Moon's surface. Centaur, consisting of an Atlas-D as booster, will use a high-performance liquid oxygen/liquid hydrogen second stage and could, theoretically, soft-land a similar 730 lb. payload on the Moon. A Vega top stage can also be fitted.

These latter vehicles probably exceed the Soviet's present capabilities, but they are still under development and it will be some time before they can be used. Whether, in fact, they will be used for lunar and interplanetary missions, in most cases has yet to be decided, for much of their development funding is for satellite research. Centaur, for example, could orbit a 10,000-lb. artificial satellite at 300 miles as an alternative to a lunar mission.

America's future space achievements are therefore very largely bound up with the question of priorities. The choice will shortly have to be made between the more "glamorous" lunar and interplanetary flights, matching, blow for blow, Soviet prestige achievements, and the more inherently "useful" developments that are likely to accrue from satellite development, affecting communications, weather survey, World mapping and reconnaissance, etc. Other vehicles concerned specifically with satellite research are Scout, Thor-Hustler, Atlas-Hustler, and the vehicles being developed for the Mercury man-in-space programme. (THE AEROPLANE AND ASTRONAUTICS, August 28, 1959, p. 61.)

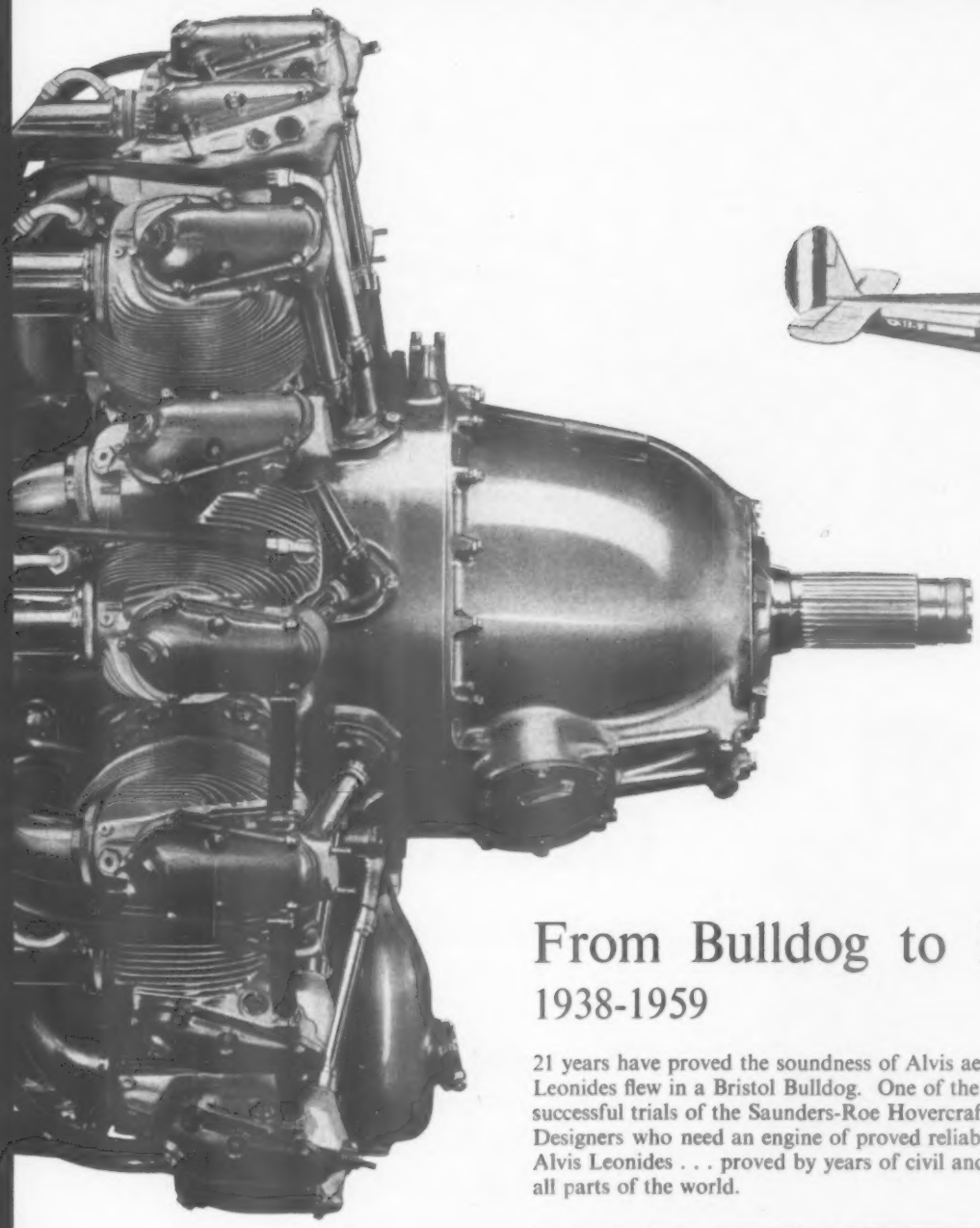
Finally, there is the NASA Nova project, a long-term

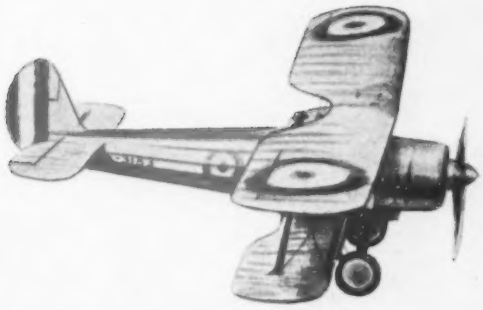
(*Continued on page 267*)



Above, this U.S. 8 oz. magnetic tape-recorder was used in Explorer.

Left, America's biggest existing rocket cluster, total thrust 360,000 lb., powers the Atlas.





From Bulldog to Hovercraft

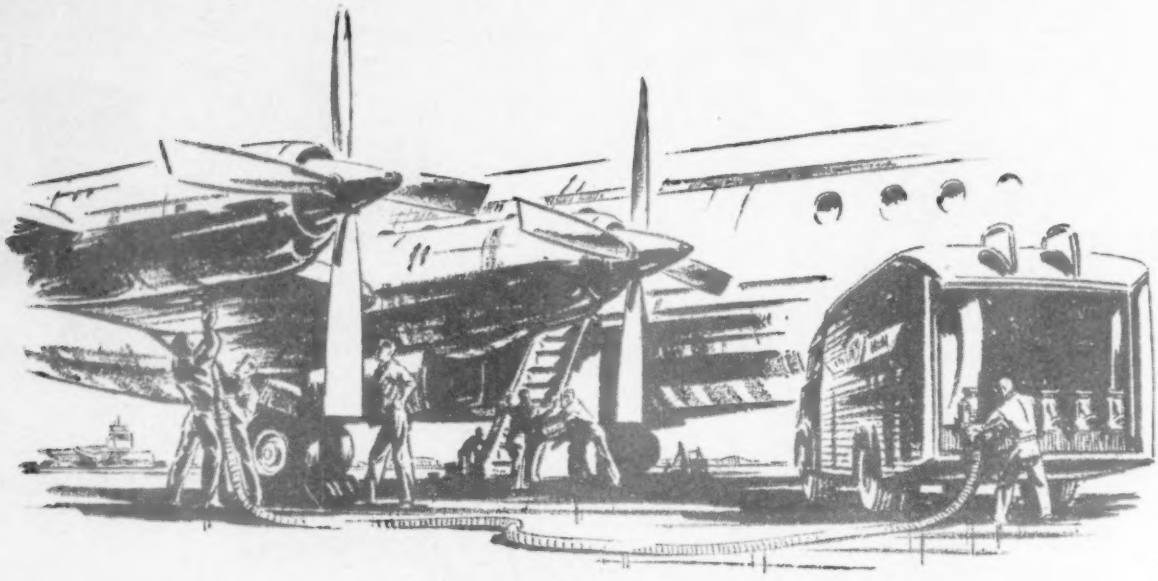
1938-1959

21 years have proved the soundness of Alvis aero engine design. The first Leonides flew in a Bristol Bulldog. One of the latest helped in the successful trials of the Saunders-Roe Hovercraft, SR-N1.
Designers who need an engine of proved reliability unhesitatingly specify Alvis Leonides . . . proved by years of civil and military flying in all parts of the world.

ALVIS

LEONIDES AERO ENGINES

ALVIS LIMITED · COVENTRY · ENGLAND



FIRST IN THE FUEL LINE

AVERY HARDOLL—A.W.E. COUPLINGS

These compact units, manufactured under licence by Armstrong Whitworth Equipment, are available in a range of standard sizes for aircraft and guided missile fuel systems. Simplicity of design gives low pressure loss and ensures long life with minimum maintenance.

ARMSTRONG WHITWORTH EQUIPMENT Hucclecote, Gloucester. Tel: Gloucester 67011

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.
MEMBER OF HAWKER SIDDELEY AVIATION

Missiles and Astronautics . . . .

(*Continued from page 266*)

development depending on the clustering of four 1.5 million lb. s.t. Rocketdyne engines in its first stage. Four- and five-stage versions of this vehicle are envisaged, which is expected to have a launching weight of about 4,500,000 lb. Calculation suggests that Nova could soft land nearly 20,000 lb. on the Moon.

This is the basic programme as presently envisaged stretching over the next seven years. In some respects, it suffers from the lack of high-thrust boosters in the early stages, which may permit Russia to make still more spectacular achievements over the next year or two without a serious challenge from the United States.

It should not be forgotten, however, that despite Russia's heavier satellites and space-probes, it is America that seems to have obtained the best value in the shape of scientific results (e.g., discovery of the radiation belts). Remarkable achievements have been made in the miniaturization of instruments, radio equipment and power supplies, and as a result more experimental apparatus per unit volume has been packed into American satellites and probes.

Just because the Americans have, so far, failed to impact the Moon is no reason for dismay. Says Dr. Glennan, "From here on space research is going to be a matter of the same determined plugging away that has characterized aeronautics research—and indeed all scientific endeavour . . . we expect to support greater effort in the universities, other non-profit institutions, and in industry in both basic research and advanced development of systems components. . . . We plan to concentrate our initial effort in deep space on lunar missions—near miss, orbiting and hard and soft landings of payloads. In this programme we will develop the techniques necessary to accomplish missions into deeper space and will use them for such missions as their reliability and the opportunity permit."

Lunik II—Trajectory and Journey Time*

AT two minutes twenty-three seconds past ten on the night of Sunday, September 13, 860 lb. of Russian knick-knacks thumped down on the Moon. The analysis which follows has been made in order to examine some of the physical problems and orders of magnitude involved in such an achievement, and briefly to survey the future.

Obviously, in order to carry out such a project the first thing to be undertaken is a study of the Earth-Moon system. From this study will emerge some elementary ideas on possible trajectories and journey times.

In the very first place calculations will be done on some kind of idealized model like the one shown in Fig. 1. But eventually extensive computor analysis will be required with a model, making allowance for the following points:—

The launching site is not on the Earth's equator.

The Moon rotates at an angle to the equatorial plane of the Earth.

The Moon's orbit is non-circular.

The gravitational fields of the Sun and of the other planets will all affect the path of both Moon and moon-landing vehicles.

With all this data in suitable form it is then possible to obtain trajectory information for various launching velocities and control methods.

From data that has been made available in the U.S.A. it appears that the minimum launching velocity of 34,800 ft./sec. results in a 5¼-day trip. This trajectory is extremely susceptible to initial errors of velocity and direction. Raising launching velocity to 35,250 ft./sec. lowers the trip time to 1.7 days and considerably reduces susceptibility to errors. It is, perhaps, reasonable to assume that the Russian trip time of 1.4 days reflects this trend.

Of course, a final selection of launching velocity and trajectory will only be made after consideration has been given to various control methods. Obviously a very wide choice exists between the system which completes all the control needs during the launching phase, and the system which allows for continuous correction throughout the journey.

Fairly elementary considerations indicate that a chemical rocket control system could be made to deal with angular corrections of 10, or a velocity change of 200 ft./sec. for less than 5% mass penalty.

All of which indicates that the extreme problem, and the one which the Russian Lunik II has demonstrably solved, is the problem of guidance. This requires that apparatus on Earth, plus apparatus on the vehicle, should at a given instant know what the velocity and vehicle position are and compare this information with what they should be. From this error data it is then possible to compute the necessary corrections required.

The control and guidance system demanding the least massive apparatus within the vehicle is the one that imparts all the necessary accuracy during the launching phase. Such a technique demands velocity measurement to accuracies of better than 1/10,000 and angular measurement to better than 30 seconds of arc.

Analysis of information released from the U.S.S.R. appears to indicate that a technique has been used which does not demand such awe-inspiring accuracies.

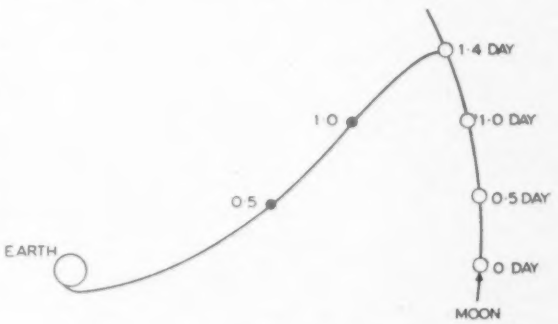


Fig. 1. Model trajectory of Lunik II.

With just "reasonable" launch accuracy, a second correction has been computed from accurate visual data derived from the sodium flare, which was ejected about 8 hours after launch and 100,000 miles up. The need for any final corrections was then assessed on the radio altimeter data at a specific time instant.

This sort of guidance and control is certainly most massive, but not too frightening in its accuracy demands. Nevertheless, it would take up quite a large part of the 860 lb. of carrier.

From which arises a further point. It would appear that Lunik II was not a vehicle bulging with expensive scientific apparatus, foolishly allowed to rush upon the Moon for a political "effect." On the contrary, it seems most likely that it was conceived as a vehicle to hit the Moon. That most of its contents were there to lower the chances of failure to insignificance. Probably some scientific measuring equipment was carried, but this was absolutely subservient to the main intention.

All of which finally points to good and careful engineering. Excellent in conception and execution. But certainly no miracles.

The Future

Having so adequately demohstrated their ability to hit the Moon, what next? The possibility of putting something down gently upon the Moon's surface immediately jumps to mind.

For an identical vehicle of 860 lb., some 500 lb. of this would be needed for propellent, tanks and propulsion system. This means that soft landings will be possible just as soon as the Earth-Moon guidance and control can be pared down to some 300 lb. This problem appears such a slight amount more complex than the one already solved, that President Eisenhower's visit to Moscow seems a handy date!

Nevertheless, the logic of the Russian "Steps into Space" has not so far followed a trend obvious to the external observer. It may be more comfortable to reserve our breath for a convenient gasp.

* Analysis by Dennis S. Carton, A.F.R.Ae.S., F.B.I.S., M.A.R.S., Lecturer at The College of Aeronautics.

Personal Flying

Per Weishaupt, our Danish correspondent, reports that what is believed to have been the first international event for home-built aeroplanes recently took place at Odense, Denmark. It was arranged by the Odense Flyveklub and the Royal Danish Aero Club as part of the latter's jubilee commemoration. Odense is a centre of home construction interest in Denmark, where in all about a dozen aeroplanes are being amateur-built, half of them Druine Turbulents, the others being Jodel D.112s.

In addition to the home-designed single-seater by Arne Hollænder (AH-1), which has previously been described in THE AEROPLANE AND ASTRONAUTICS, Hans Axel brought the first finished Turbulent to Odense, and Gunnar Fjord Christensen test-flew the first Jodel on the day of the rally.

Although this did not quite get the international character intended (it was a particular disappointment that the virile French movement did not even answer an invitation), machines came from Switzerland (a Minicab), Germany (Stark Turbulents), Belgium (Bernhard Neefs with a Tipsy Nipper) and Norway (all-metal Larsen Special), while Sweden contributed an observer.

Neefs, of course, gave some very lively demonstrations, and Mr. Stark and others showed what the beautifully finished Stark Turbulent Ds—two already Danish registered—could perform. The German Turbulent is almost a redesign of the original French version, powered by a new 45 b.h.p. Stamo 1400 engine; it is cheap, strong and a joy to fly. Several other interesting designs are taking shape at this new aircraft firm.

Many Danish enthusiasts came despite pouring rain to the rally, which achieved its main intention of getting them together to talk things over. More home-constructed aircraft are going to be built, and two new Danish designs will probably also materialize during the coming years. One is an amphibian and the other a small two-seater, with Volkswagen engines.

• • •

After some rather difficult years for private aviation in Denmark prospects are now looking better. This is partly because of growing interest in home construction and for the small cheap single-seaters which can now be bought, and partly connected with the growth of business flying.

Denmark lost all its private aircraft during the War and Occupation, but personal flying quickly revived after 1945, with the introduction of the Danish KZ III and VII light aeroplanes, and imported Austers. For many years it was very difficult to get permission to import new aircraft, although these became more and more essential. Import licences were gradually given and now restrictions have more or less disappeared, as has the original 7½% import duty.

Many American types, such as the Cessna 150, 172 and 175, Piper Super Cub, Tri-Pacer and Apache, and Aero Commander have now been imported to Denmark and also the Czech Aero 45 and Meta-Sokol, but of course (adds our Danish correspondent), no English types.

There is now a general optimism for light aircraft sales, many foreign firms being represented, and sound competition is developing between the representatives. The Danish market is naturally limited, but some firms also try to sell to the other Scandinavian countries. The second largest Danish industrial firm, Danfoss, has formed an Aviation Department which has just ordered 50 Tipsy Nippers after getting the representation for all four Scandinavian countries, West Germany and the Eastern Bloc. They are also using and selling Aero Commanders.

While Denmark is too small to be a very good country for flying, its geographical position and sea surrounds nevertheless make the aeroplane a useful vehicle for many journeys. The internal SAS routes have been increasingly popular during recent years. Business people are beginning to understand that they can use their own aircraft too, not only for internal flying, but for journeys all over Europe.

Howard Levy photograph

STOL BUSINESSLINER.—A new photograph of the Dornier Do. 28 (light twin development of the Do. 27), which showed its remarkable STOL performance at Paris this year.

• • •

A project which started in the U.K. recently achieved fulfilment in Australia, when the Department of Civil Aviation granted a C. of A. to the Millicer Air Tourer. This wooden low-wing monoplane was successful in the 1953 Royal Aero Club design competition, and its development "down-under" has been subsidized to the extent of £A1,000 by the Aero Club Federation of Australia.

The two-seat side-by-side Air Tourer was designed by a team led by Polish-born Mr. H. K. Millicer, chief aerodynamicist of the Government Aircraft Factories, Fishermen's Bend. The aircraft was built by a group within the Ultra-Light Aircraft Association of Australia, and is to be produced in series by East-West Airlines, of Tamworth, New South Wales.

• • •

Piaggio are in the business flying news again. McAlpine Aviation of Luton have announced that they have been asked to supply a six-seater Piaggio P.166 to John Blackwood, Hodge and Co., Ltd., a leading firm of engineers, for executive use. With the aircraft, which will be delivered later this year, McAlpine's will provide its full advisory service on business flying.

Figures collated from McAlpine's own P.166 operations show that the cost per passenger seat-mile can drop to 7d. on a yearly utilization of 200 hours, or as little as 4½d. on 400-hour utilization, with four seats filled.

• • •

As Confucius—or was it Mao Tse-Tung?—might have said, there are many different ways of saying the same thing. The favourable impressions which we recorded recently after flying the Mooney Mk. 20 have also been confirmed by Mr. Chuck Banfe, writing in the American magazine *Skyways*.

He said, *inter alia*, "Al Mooney doesn't dream up anything but a high-performing slick-looking aircraft. Starting with his Culver Cadet back in 1930, the unquiet birdmen began to beat a staccato for the design genius who created this high-performance slick-looking airplane. . . .

". . . The instrument panel tilts forward, making it easy on the eyeballs. The panel is not over-gross with instruments and there is plenty of garden space for more. . . . The control column is square in the modern vein and the right controls can be disengaged. . . .

". . . The gear . . . requires a positive action and locks under the instrument panel with a warning system if the pilot

(*Continued on page 269*)

SMOOTH TURBULENCE.—The German-built Stark Turbulent, seen left in Danish markings, with full C. of A., has wheel spats, coupé hood, steerable tail-wheel and many other refinements. Power is from a 45 b.h.p. Stamo 1400 Volkswagen-derived engine.

Economy and reliability achieved by Rotax!

The same basic alternator and control is used on...

FRIENDSHIP · ARGOSY · VULCAN · VICTOR

Developed as a private venture, this equipment is now available to you.

ROTAX

FULL COVERAGE BY ROTAX SERVICE IN MOST PARTS OF THE WORLD

ROTAX LTD., Willesden Junction, London, N.W.10. (Elgar 7777).
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., Melbourne and Sydney, Australia.
LUCAS-ROTAX LTD., Toronto, Montreal and Vancouver, Canada.

Precision Fabrication work in Heat-resisting steel for Guided Missiles and related equipment

B.A.P. have development and production facilities for Guided Missile work, and offer manufacturers in the industry a first class fabrication service in heat-resisting steels for components and ancillary equipment

• • •

A.I.D. and A.R.B. approved

BURNLEY AIRCRAFT PRODUCTS LTD

FULLEDGE WORKS · BURNLEY · LANCS · ENGLAND

Telephone: 3121/2 and 3203 Burnley (3 lines) Grams: 'AIRCRAFT' Burnley

REPAIR DIVISION: Britannia Works, Queensgate, Burnley. Telephone: 4102

INDUSTRIAL FABRICATION DIVISION: Grosvenor St., Stoneyholme, Burnley. Telephone: 3184

Associated with RENFREW AIRCRAFT & ENGINEERING CO. LTD RENFREW, ONTARIO, CANADA

(*Continued from page 268*)

has pulled a boo-boo. . . . The controls have a nice even feel to them! Laminar flow design can take a bow for that. At low speeds, with an up-me-bucko from the laminar flow, the Mark 20 affects a stable flying configuration. . . .

". . . Al Mooney sure rang the bell when he took the Mark 20 off the design board. He has a light twin coming out which Norm Hoffman (the Vice-President Sales) . . . beats the drums about as if the background music were John Phillip Sousa leading 'When the Saints Come Marching Home.' . . .

"If it can cut the mustard as neatly as the Mark 20, it might well blast away at the light-twin market and fly off with a lion's share of the corporate dollar!"

Which is more or less what we said.

* * *

And now for a round-up of flying-club activity, which we will present in abbreviated form from time to time.

● Elstree Flying Club report that 580 hr. 25 min. were flown in July, and 710 hr. 45 min. (an all-time club record) in August. Total for first eight months: 3,484 hr. 40 min. Early in October, technical lectures on navigation, theory of flight, aviation law, meteorology, etc., begin, and this year are open to members of other clubs. Fees: four guineas, or three guineas to Elstree members.

● Six months ago the Oxford Aeroplane Club re-formed under an independent company. During this period, the hours flown exceeded 80% of previous total for whole year. August was again a record month. Climax to August was the "At Home," when a rather high percentage of enemy penetrated defences and earned free teas. Aircraft spot landing was won by Mr. P. W. White, of Southend Flying Club, and parachute landing competition by Dennis Smith, of the Oxford Parachute Club.

● Ardent and enthusiastic aviators arrived at Stapleford Tawney in their dozens on September 5, for the second air rally of the Kelvin Hughes (Barkingside) flying section. Organized in conjunction with the Herts and Essex Flying Club, and its C.F.I., Mr. Gerry Quinn, the meeting included not-too-difficult flying competitions and a crazy exhibition by test pilot Barry Radley. First prize of the day went to Bill Leary and his navigator Miss Susan Radnor, while Ron Turner took second prize and David Gully, third. All pilots of the Kelvin Hughes and Smiths flying section are able to get flying at one-quarter the normal cost through the companies assisted scheme.

● We hear that the former Surrey Flying Club has settled down at Biggin Hill, which has proved satisfactory as a club airfield, and has undergone some reorganization. The running of the aerodrome will be undertaken by Surrey Aviation, Ltd., and a new company, the Surrey and Kent Flying Club, Ltd., has been formed to run the club. Biggin Hill was closed for club flying last week-end for the annual Battle of Britain display, but the club aircraft were "diverted" to Flers, in Brittany, for an impromptu rally, organized by the indefatigable Father Amiard.

● Fair Oaks Aero Club has had a busy season, including a Tiger Cub display, and Vickers-Armstrongs' social evening, culminating with an "At Home" and tea patrol last week-end. There is to be a display of American Piper aircraft at the airfield on September 26 and 27, when the Cub 150, Tri-Pacer, Apache, Comanche and Pawnee are to be demonstrated.

Gliding Notes

by Dr. A. E. Slater

THREE World's records for speeds round triangles were broken during the Texas soaring camp which was held during the first half of August, and all by Dick Schreder (pronounced Skreeder) in the high-speed HP-8 with which he had finished second at the national contests in July; they were for the 100, 200 and 300 km. triangular courses, though Terry White, relaying this information to Gp. Capt. N. W. Kearon, did not give the speeds. The current record speeds are, or were, 60.22, 55.0 and 49.4 m.p.h. respectively.

Some 42 pilots attended the meet with 28 sailplanes and covered 10,144 cross-country miles.

Another World's record was beaten in Germany on June 20 by Karl Bauer, who gained 31,711 ft. (9,665 m.) in a cloud flight, beating the climb of 30,100 ft. by W. S. Ivans in a wave at Bishop, California, at the end of 1950. Thus the rivalry between waves and cumulo-nimbus clouds goes on; for instance, the British National record for height gain is 28,200 ft. in a New Zealand wave by Philip Wills, and that for the U.K. is 28,500 ft. by John Williamson in an English cu-nim. Cloud-flying, by the way, is not allowed in Germany—officially.

* * *

AMONG this summer's cross-country flights not yet reported are two by Alfred Warminger, of Norwich, who carries out his soaring as a sort of one-man private enterprise and has no club, complete with press officer, to tell the World about it. Since completing his Gold "C" and gaining a Diamond for altitude by reaching 30,000 ft. in a cu-nim two years ago, he has been after the second Diamond for a 300-km. goal flight.

On August 30, the day when Dennis Burns made a dog-leg 300-km. flight from Lasham eastwards to Lewes and then westwards to Exeter, Warminger tried for a similar dog-leg from Swanton Morley, first 100 miles southwards to Maidstone and then 90 miles W.S.W. to Beaulieu in Hampshire. But he missed his goal by 11 miles because, on the final glide from 5,500 ft., he made only 24 miles through down-current areas instead of the 35 miles which his Skylark 3 should have done in still air. On the way, he had to descend to 1,000 ft. over the middle of the Thames in order to get thermals wafted from oil refineries by the light northerly wind.

However, on September 3 Warminger succeeded in reaching his 300-km. goal at Weston-super-Mare with a light following wind, 4½ hours after a winch launch at Swanton Morley. In contrast to the first flight, when he had been down to 400 ft. near Tonbridge, this time he was above 4,000 ft. all the way, and exceeded 9,000 ft. three times, which was just as well because clumps of good cumulus were often separated by 10 or 20 miles of dead air.

* * *

BERNARD MONOD, aged 26, was not quite an "ab initio" when he made his first glider solo at Beynes, near Paris, on July 17, for he had done 18½ hours in aeroplanes as well as 4½ hours' dual in gliders. But he made the necessary three flights for his "B" certificate that day, passed his "C" and his five-hour test for Silver "C" in a single flight on the next day, and finished his Silver "C" on the day after with 1,000 m. altitude and 50 km. distance.

Aviasport, in reporting that these five flights were made within 48 hours, claims that this feat is *peut-être unique* in the history of soaring flight.

* * *

RELEASED at 50 ft. from a towline launch at East Grinstead on August 16, a model glider of 6-ft. span disappeared into a cumulus cloud 36 minutes later. It reappeared occasionally during the next three minutes, but after that was never seen again, so nobody knows whether it beat the official British model glider record of 1 hr. 30 min. Gatwick Met. Office said that cloud base was just under 5,000 ft., and East Grinstead is about 400 ft. up, so the model climbed about 4,500 ft. in the 36 minutes.

A 1 ft./sec. upcurrent should be enough to start a model climbing, but sailplanes, which need a 3 ft./sec. upcurrent to allow for extra sink in tight circling, rarely start thermal climbs from as low as 150 ft. above ground, though climbs from 400 ft. are fairly common. So this model observation gives a measure of how fast hot air accelerates upwards—at least, to begin with.

* * *

THIS summer's well-established 300-km. "milk run" from Dunstable to Roborough, near Plymouth, continues to operate, and on September 5 Colin Richardson made the journey and earned a Diamond. In the early stages of his training, so far as I recollect, he was a few weeks behind his mother, but he now has the field to himself.

On Saturday, Sept. 12, in a light N.N.E. wind, the London Club had one of their rare lee waves. Although it did not form a continuous strip this time, it echoed the irregularities in the outline of the Downs with the usual displacement to leeward—in this case to S.S.W., so that lift was found directly over the slope of the westerly projection known as the "the bastion." The usual very low inversion was evident to pilots who could feel themselves entering warm air at only 400 ft. as they went up on the winch cable.

The wave was found by John Westhope at 09.00 hrs. and raised him 300 ft.; later, John Jefferies, with a pupil in a T-21, climbed at 3 ft./sec. to 1,300 ft.

At Sugarswell Farm, on the former Shenington airfield, live H. J. Greenway, snr., an instructor at the Coventry Gliding Club, and his son, Howard, who made 173 miles northwards from there to Brotton, near Middlesbrough, after an aero-towed launch at 11.45 hrs. by Peter Martin, who garages his Tiger Moth at the farm. Another club member, Alwyn Findon, launched from there half an hour earlier, went farther up the coast but is unsure whether he made the 300 km. (186.4 miles). The *Banbury Guardian* of Sept. 3, which gives the news but not the date of the flight, thinks the "C" in "Gold C" is short for Certificate.

Aerobatics at Dunstable

PLENTY of clear air was available for the Third Annual (and Second National) Glider Aerobatic Contest at Dunstable on Sunday, September 20, so competitors could be released at 2,500 ft. instead of being confined by low cloud to 2,000 ft. as they were at each previous contest. We should, of course, have said 760 metres instead of 600, in deference to the Judges' Panel, who once again consisted of members of the Lockheed International Aerobatic Trophy Panel, with Major Oliver Stewart as chairman and A. W. "Bill" Bedford as additional adviser on the gliding aspect.

Another difference was that, in the absence of wind, the judges did not have to lean over backwards to watch carelessly drifting competitors. Nor did anyone this time get between the judges and the sun. In fact, "positioning" was exemplary for once; and another lesson learned, from points forfeited on previous occasions, was not to continue below 500 ft.

There was not a great variety of aerobatic figures on this occasion—lots of loops, many chandelles and several spins, and the laminar-flow Olympias flew upside-down but did no rolls in straight-ahead flight. However, there were marked differences in neatness of execution, intervals between figures, and other details, among the 15 competitors, of whom five came from the R.A.F., four from the Army, and one from the Navy (Retd.), leaving only five from civilian clubs.

Flt. Lt. B. B. Sharman, from the R.A.F. club at Andover, was judged the winner with 247 points, for a most polished performance, including a wide circle upside-down, in an Olympia 419. He won the Jack Hanks trophy and a cash prize donated by Mr. J. B. Emmott, of Kenilworth, who has suddenly entered the gliding world as a patron by offering £50 worth of prizes to be distributed between the leading competitors at this contest, provided they spend it on gliding equipment.

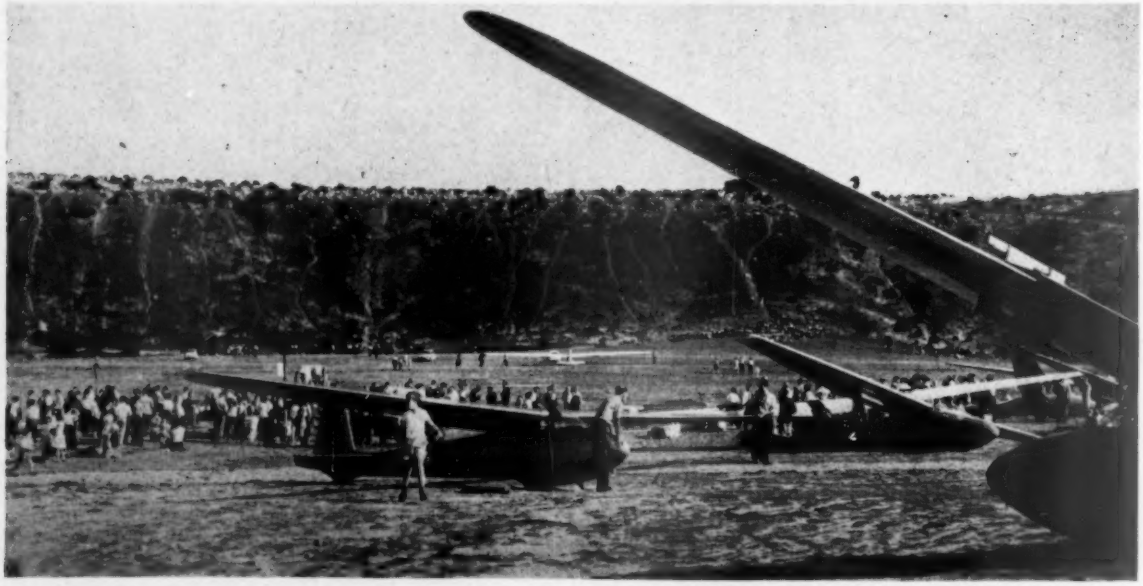
Second prize winner, who also received a year's free subscription to THE AEROPLANE AND ASTRONAUTICS, was Peter Dirs, of the London Club, who earned 238 points with an Olympia.

Lieut Cdr. Humphrey Dimock, R.N., of Portsmouth Naval Gliding Club, recently put on an aerobatic show over his home ground, so was in good practice and crowded in a great many manœuvres during the descent of his Sky; he somehow manages to execute conventional figures in an individual style which is unmistakable, and gained third prize, with 232 points.

Flt. Lt. D. S. Bridson, who flies with the London Club as well as the R.A.F., came fourth in an Olympia 419 with 230 points.

During the lunch interval, several club members took off for a 66-mile out-and-return race to Kidlington, north of Oxford, and back. Roger Mann won it in just under 2¼ hours, with Geoffrey Stephenson five minutes behind.

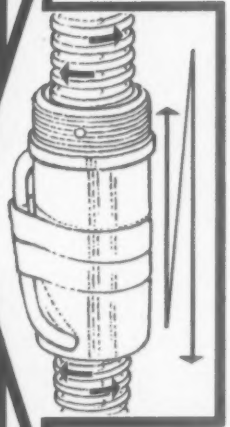
A spot-landing contest, which every aerobatic competitor had to try for at the end of his flight, resulted in a tie between Flt. Lt. Sharman and Flt. Lt. L. Kurylowicz, who both missed the spot by only three feet.—A.E.S.



Photographs copyright "The Aeroplane and Astronautics"

SAILPLANE OCCASION.—A large number of visitors watched the aerobatic contest at Dunstable last week-end. Above right, the winner Flt. Lt. B. B. Sharman has on his right, P. Dirs (second) and on his left Lieut. Cdr. H. R. Dimock (third).

Bristol Siddeley provide a comprehensive range of high precision recirculating ball and lead screws and splines for universal applications.

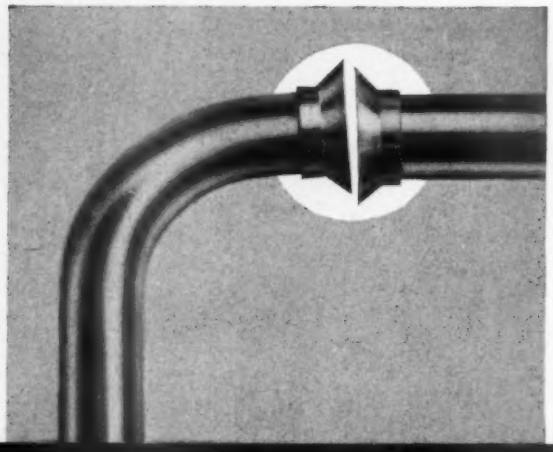


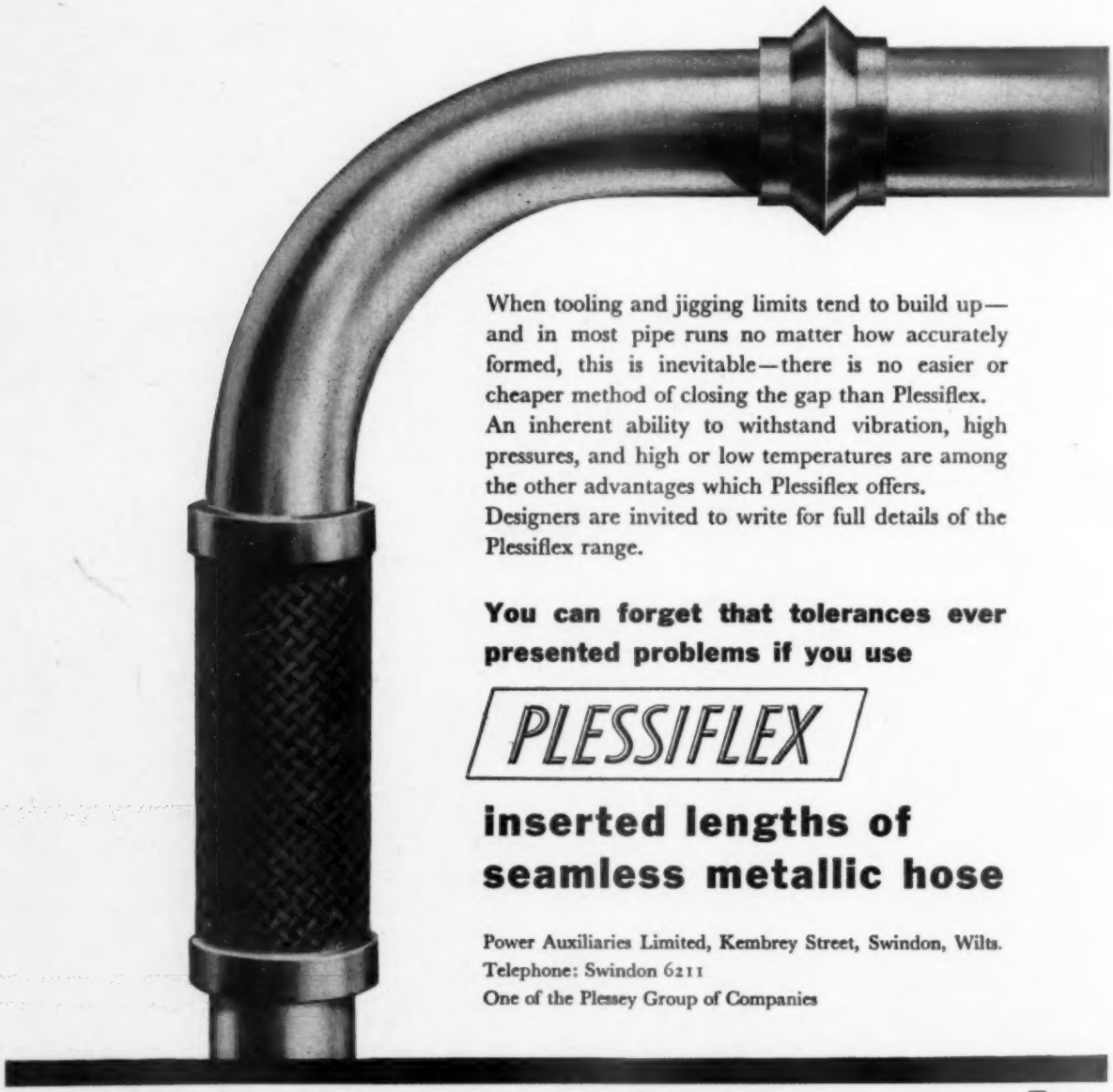
HIGH EFFICIENCY
BACK-LASH ELIMINATION
LONG LIFE
LOW MAINTENANCE FACTOR

Up to 80% reduction in power can be achieved for actuation compared with conventional methods.
Ability to run at high temperatures with and without lubrication.
Over 2,700 applications already established in all fields of engineering.
Complete technical and manufacturing co-operation with Beaver Precision Products Inc., Detroit.

BRISTOL SIDDELEY ENGINES LTD.
COVENTRY · ENGLAND

A question of tolerances?





When tooling and jigging limits tend to build up—and in most pipe runs no matter how accurately formed, this is inevitable—there is no easier or cheaper method of closing the gap than Plessiflex. An inherent ability to withstand vibration, high pressures, and high or low temperatures are among the other advantages which Plessiflex offers. Designers are invited to write for full details of the Plessiflex range.

You can forget that tolerances ever presented problems if you use

PLESSIFLEX

inserted lengths of seamless metallic hose

Power Auxiliaries Limited, Kembrey Street, Swindon, Wilts.
Telephone: Swindon 6211
One of the Plessey Group of Companies

PAL 6

Correspondence

Thanks for Everything

CROYDON is about to close for ever. I feel there will be many who will wish to express their appreciation of the courteous and friendly treatment they have received for so many years from everybody there—the airport manager, the control officers, the "Met.," the Customs, the landing officers, briefing and the marshals and porters.

I hope we may meet them again.

Lloyd's, London. G. Q. REISS.

Sales Commentators?

AS a salesman who has visited the S.B.A.C. Show and Flying Display in most years since 1952, I have always been impressed by the wonderful opportunity given to the flying display commentator in that he has a more or less fixed audience for about two hours. I have also noticed that as the years go by "pure" commentary ("He is now looping the loop") has given way to some extent to sales talk ("This mark has 100 hours' flying experience").

I regard this as a progressive and realistic step, but I think very much more could be made of this golden opportunity than is being made at present. Might it be a good idea to allow the commentary on each aircraft to be given by a representative of the manufacturer?

Leatherhead, Surrey. D. W. LANCASTER.

Steam-launching for Gliders

I WONDER why it is that up to now nobody has used the well-known "thrust-giving" possibilities of hot water stored in high-pressure bottles as a mean of launching gliders quickly and cheaply? All one needs is a 50-gal. high-pressure boiler (about 700 p.s.i.) put on a light car. Heat up cold water to about 270° C. (520° F.) with oil burners or cheap coal fires.

Feed some 10-12 gal. of this "hot water" into super-light (only about 25-lb. empty weight) high-pressure bottles placed at the C.G. of the high-performance glider. Disconnect the feeder line from the car-boiler and open the expansion valve to the hollow-bladed stern propeller of the sailplane.

The expanding "hot-water-wet-steam" mixture, blowing out of the blade-tips of the stern-prop between the "V"-tailed elevators will shoot your glider in a few seconds up off the ground with about "1 *g*," and in about one minute with about half of that thrust up to some 1,500 ft. or even 2,000 ft. high into the sky.

Wiesloch/Heidelberg. JOS. REDER.

Flying Inns

DUSTY but defying time I have a pen sketch of the lounge of the "Canopus" pub at Rochester as it was in 1938. On the wall above the fireplace is a picture of the flying-boat "Canopus." Locally, here at Gloucester, is another pub with a sign outside depicting the Gloster E.28/39, its name being the "Jet and Whittle."

Beer has almost been an aircraft accessory down the years, keeping flying types and ground engineers in good heart (after the jobs have been done), and many an aeronautical problem has been resolved over a pint of the best.

Now which pub in this country can claim to be the first named after an aircraft? Where and how old is it?

Gloucester. L. MORGAN.

[For a start one immediately thinks of G. K. Chesterton's "Flying Inn" which got into print in the very early years of this century, but then it was only a fictional edifice.—ED.]

A Curtiss Prop

IT seems highly probable that the propeller of which Mr. K. R. F. Kenworthy writes in your September 11 edition was fitted to a Curtiss O.X. engine in a Curtiss J.N.4 military tractor biplane.

In the autumn of 1914, Cdre. Murray Sueter sent the Hon. Maurice Egerton to the States to see what types of training aeroplanes they had to offer. A number of types were bought but the Curtiss was the only one which came over in any quantity.

These were erected at Hendon which at the time was commanded by Harry Busteed (Air Cdre. retd.) and were widely used in training establishments in this country and I believe at the school at Vendome.

The Curtiss J.N.4 was a nice gentlemanly aeroplane but rather underpowered. It had dual control and a wheel mounted on a Deperdussin-type arch instead of a joy stick.

The engine had eight cylinders water-cooled, with spring-opened but positively closed inlet valves and a very poor locking arrangement on the propeller hub.

The main defect in the engine as originally delivered was the magneto, the insulation of which gave out as soon as the engine got hot, and for some weeks in 1916 there were forced-landed Curtisses in all directions about 20 miles radius from Hendon.

London, W.1. G. F. SMYLIE.
(Air Cdre. R.A.F. retd.)

Wroundabout

Moonday Morning Feeling. Quizzed on how long it would take to get a man on the moon, an official of the American State Department said yesterday: "Five days. One day to get him there, four days to get him through the Russian Customs." *Daily Express, Tues., Sept. 15.*

*

Farnborough Hangover (Technician's Day)

"I hear the Hovercraft uses a dipstick instead of an altimeter."

"Actually, I'd like an orange squash but don't tell them back at the works."

Technician to lady "technician" inspecting capacious hold of Argosy: "May I have the next dance?"

Regrettably, but inevitably, 707 jokes were rife. One suggestion was that a recent Boeing advertisement may hold a clue to the troubles. It states that of 72 Boeing 707 jetliners which have rolled out of their Renton plant "nearly 57 have been delivered." That little short and how much it is.

*

*

PRO and CON—1. Delving in a dictionary for a suitable title for one of this column's P.R.O. jests, I was struck by the number of words with the prefix "Pro" which were cynically relevant to the craft of P.R.O.-manship. Public (and Press) Relations Officers are now the *prima donnas* of the aviation business, rating second only to test pilots who are, I suppose, the *prima ballerinas*. P.R.O.s and their wives lead trying lives (nobody has ever seen an *old* P.R.O.). Only their sense of humour sustains them. I count on it during the coming weeks when *Wroundabout* will print a selection of such choice definitions as:—

PRO: A professional player, either on the stage (press conference) or at certain outdoor sports (S.B.A.C. Display, Paris Show, etc.).

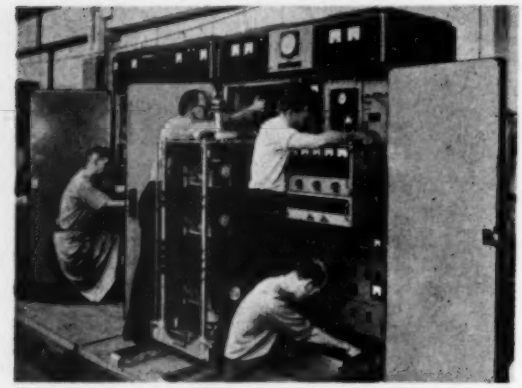
PROchronism: An error in chronology in assigning an event to too early a date ("The prototype will fly in two years' time.").

PROclamation: An announcement by the sovereign in council of an executive act ("The Chairman says . . . ").

PROdigious: Enormous; amazing; monstrous ("Performance, old boy, not costs . . . ").

by Gyrens

NOTES AND EVENTS



FOR NEW ZEALAND.—A 50-cm. Type S264A Marconi high-power surveillance radar system has been chosen for the new Wellington Airport at Rongotai, New Zealand. Here engineers at the Chelmsford works of Marconi's Wireless Telegraph Co., Ltd., assemble the transmitters.

FUEL FACTS.—An interesting and attractive booklet has been published by Shell Aviation Department entitled "The Power Behind the Turbine." It is very well illustrated and discusses various aspects of fuel technology in general terms. The booklet can be obtained from Shell Aviation Dept., St. Helen's Court, London, E.C.3.

TECHNICAL SALES.—Technograph Electronic Products, Ltd., has announced changes in its sales division. Mr. L. C. Smith, technical sales representative of the company, has been appointed sales manager. The new technical sales representative is Mr. P. Bartlett, who will be responsible for the technical sales division in the computer, guided weapons and airborne equipment fields.

NIPPER PROGRESS.—A contract was recently signed between Avions Fairey S.A. in Belgium and the company's Scandinavian agent for the supply of 50 Nippers by the end of June next year. Delivery is imminent of the fully approved dual-ignition HEPU engine which will cost an additional £100 or so.

LECTURE COURSES.—Northampton College of Advanced Technology have announced their courses of post-graduate lectures in aeronautical engineering for 1959-60. These courses cover: An Introduction to Aero-elasticity; Three-dimensional Aerodynamics; Aeronautical Applications of Computing Methods; Boundary-layer Theory and Control; Performance Design of High-speed Aircraft. Details can be obtained from the College at St. John St., London, E.C.1.

COMPANY MOVE. — The entire offices and works of Hardy Spicer, Ltd., have been transferred to new premises situated at Chester Road, Erdington, Birmingham, 24. Telephone, Erdington 2191.

LODGE CONTRACT.—A new spark plug, designated RS35R, has been specially developed by Lodge Plugs, Ltd., for the Curtiss-Wright Turbo Compound engine. The company has received a contract from TWA and Flying Tigers for the exclusive use of these plugs in their DC-7 and Constellation fleets.

Aviation Calendar

September 26-27.—Rally organized by the Genoa Aero Club, **Italy.**

September 29.—R.Ae.S. Luton Branch lecture, "Ballistic Missile Design," by E. C. Cornford (joint lecture with E.E.C.), at English Electric, **Stevenage,** at 18.30 hrs.

September 29.—Society of Instrument Technology lecture, "An Engineer's Approach to a Servo Problem," by A. Clausen, O.B.E., B.Sc.(Eng.), at Manson House, 26 Portland Place, **London,** W.1, at 18.30 for 19.00 hrs.

October 1.—R.Ae.S. Isle of Wight Branch lecture, "Aircraft Accident Investigation," by R. C. Clarke, at the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, **E. Cowes,** I.o.W., at 18.00 hrs.

October 7.—R.Ae.S. Graduates' and Students' Section lecture, "Lunar Probes," by J. E. Allen, at the Library, 4 Hamilton Place, **London,** W.1, at 19.30 hrs.

October 7.—R.Ae.S. Weybridge Branch lecture, "Fatigue in Modern Aircraft Structures," by D. M. McElhinney, A.F.R.Ae.S., at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

October 7.—British Institution of Radio Engineers lecture "The Use of Transistors in Communication and Control," by E. Wolfendale, B.Sc., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, **London,** W.C.1, at 18.30 hrs.

October 8.—University of London extra-mural studies lecture, "Thermal Winds and Jetstream Forecasting," by C. E. Wallington, M.Sc., at the Kronfeld Club, Basement, 74 Eccleston Square, **London,** S.W.1.

October 9.—Helic. Assn. of Gt. Britain lecture, "The Programme of Development Testing for a Helicopter," by T. G. G. Newbery, B.Sc.(Eng.), A.M.I.Mech.E., A.F.R.Ae.S. (Ministry of Supply), at the Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

October 13.—R.Ae.S. lecture, "Instruments and Flight Control Systems for Transport Aircraft," by W. H. McKinley, at Napier Senior Staff Canteen, **Luton Airport,** at 18.15 hrs.

October 14.—Society of Instrument Technology lecture, "An Automatic Analogue Computer for Missile Homing Investigations," by J. G. Thomason, B.Sc., A.Inst.P., A.M.I.E.E., at Manson House, 26 Portland Place, **London,** W.1, at 18.30 for 19.00 hrs.

MACHINE TOOL AGENCY.—Elgar Machine Tool Co., Ltd., have been appointed exclusive distributors in the U.K. for the range of Zerbst heavy-duty facing and short bed lathes. The largest lathe in this range can swing work up to 6,300 mm. diameter.

New Patents

APPLICATIONS ACCEPTED

822,472.—**Rolls-Royce, Ltd.**—"Jet propulsion nozzles."—June 20, 1957. (June 20, 1956.)

Printed specifications of the above will be available on October 28, 1959, and the opposition period will expire on January 28, 1960.

822,811.—**British European Airways Corporation.**—"Apparatus for de-frosting the external surfaces of aircraft or other surfaces needing similar treatment."—Dec. 28, 1956. (Feb. 14, 1956.)

822,819.—**Flight Refuelling, Ltd.**—"Apparatus for transferring liquid from one aircraft to another in flight."—June 11, 1957. (June 11, 1956.)

823,006.—**Shepherd, G. R.** (Westinghouse Electric International Co.).—"Propulsion systems for helicopters."—Nov. 18, 1957.

Printed specifications of the above will be available on November 4, 1959, and the opposition period will expire on February 4, 1960.

Company Notices

NEW COMPANIES

P.H.G. Aviation, Ltd. (635,070).—Private co. **Reg.** August 14. Cap. £100 in 5s. shs. Objects: To carry on the business of tourist and travel agents and contractors and to facilitate tourist air traffic, etc. Subscribers (each with one sh.): Douglas G. Carmichael, Harlyn, Sunningdale, solicitor; Derek J. Northcott, 24 Longcroft Avenue, Devizes, solicitor's clerk. Directors not named. Solrs.: Herrington and Carmichael, Camberley.

Halifax Gliding Club, Ltd. (635,147).—**Reg.** August 17, as a company limited by guarantee without share capital. The original number of members is 500, each liable for £1 in the event of winding up. The management is vested in a Council, the first members of which are: Miss N. Bramham, 13 Orchard Grove, Crossgates, Leeds, 15; D. J. Westerside, Tor Vean, Pinner Lane, Southowram, Halifax; Ian M. Fisher, A. M. Rose, M. H. Lickess, Frederick Rees and D. M. Pickering. Solrs.: P. Fielding, 8 Harrison Road, Halifax.

Surrey and Kent Flying Club, Ltd. (635,841).—Private co. **Reg.** August 26. Cap. £6,000 in £1 (5,000 ordinary and 1,000 preference) shs. Directors: Leonard J. Marshall, 72 Kneller Gardens, Isleworth; Peter L. Chinn, 26 Shawley Way, Epsom. Sec.: P. L. Chinn. Reg. off. 19 Eastcheap, E.C.3.

Needham and Jackson, Ltd. (635,878).—Private co. **Reg.** August 27. Cap. £5,000 in £1 shs. Objects: To carry on the business of general precision, mechanical, motor, aeronautical and electrical engineers, etc. Directors: Victor E. Needham, 69 Gertrude Road, West Bridgford, Notts; Harry N. Jackson, 72 Pierrepont Road, West Bridgford, Notts. Sec.: Margaret Jackson. Reg. off.: 75 Regent Street, Nottingham.

Personal Notices

BIRTHS

Bennett.—On September 1, at Serbo Byolin, Tokyo, to Pamela, (*née* Barber), wife of Gp. Capt. H. T. Bennett, R.A.F., Air Attaché to the British Embassy, Tokyo—a daughter.

Britton.—On September 1, at Tangmere, to Ivy, wife of Flg. Off. Bob Britton, R.A.F.—a son.

Cresswell.—On September 7, at R.A.F. Hospital, Wegberg, Germany, to Blanche, wife of Flt. Sgt. P. Cresswell, R.A.F. Wildenrath—a son.

Dowling.—On September 5, to Ethel, wife of Sqn. Ldr. D. E. B. Dowling—a son.

Eades.—On September 6, to Jill (*née* Vasse), wife of Sqn. Ldr. G. O. Eades—a daughter.

Hardcastle.—On September 11, at Hornchurch, to Audrey (*née* Sash), wife of Flt. Lt. J. Hardcastle, R.A.F.—a daughter.

Hunter.—On September 4, at Rustington, to Sheila (*née* Hayman), wife of Flt. Lt. K. Hunter, R.A.F.—a daughter.

Hutchings.—On September 11, at Forbes Fraser Hospital, Bath, to Daphne (*née* Clenmow), wife of Flt. Lt. R. J. Hutchings, R.A.F.—a son.

Jordan.—On September 10, at R.A.F. Hospital, Wegberg, Germany, to Sheila, wife of Sqn. Ldr. J. Jordan, R.A.F.—a son.

King.—On September 8, at Ardoch Lodge, Lewdown, Devon, to Margaret (*née* Wood), wife of Flt. Lt. S. King, R.A.F. Manby—a son.

Livingstone.—On September 7, at St. Margaret's Hospital, Epping, Essex, to Margaret (*née* Braendle), wife of Sqn. Ldr. A. G. W. Livingstone, R.A.F.—a daughter.

McCullagh.—On September 4, at R.A.F. Cosford, to Amaryl (*née* Dowling), wife of Flt. Lt. E. A. McCullagh, R.A.F.—a son.

Morgan.—On September 1, at the Lyle McEwan Hospital, Elizabeth, S. Australia, to Sue (*née* Davies), wife of Dr. A. M. Morgan, R.A.F.—a son.

DEATHS

Hare.—On September 6, Wg. Cdr. Bertram William Trelawny Hare, of Curtisknowle, Totnes, Devon.

Arnold.—On September 5, Flt. Lt. V. E. Arnold, A.F.C., late of the Rochester Flying Club and 24, E.F.T.S., after a long illness at Breadsall, Derby.

every aircraft requirement in piping and ducting . . .

. . . including aircraft and missile Ground Support Equipment

Full information on any of the above products is available on request from

AVICA

AVICA EQUIPMENT LIMITED
Mark Road, Hemel Hempstead, Herts.
Tel: Boxmore 4711 Cables: Avica Hemel Hempstead

AVICA INTERNATIONAL
1 rue du Temple, Geneva, Switzerland

SUPER AERO 45

Now available with full Public Transport C. of A.

★ Attractive all-metal 4-seat aircraft of modern design, built to the finest engineering standards. Ideal for private and business users.

★ Economical operation with comfort and safety. Demonstrations upon request.

★ Early delivery with British validated C. of A. Sterling payment. Spare parts readily available.

Sole U.K. distributor for OMNIPOL, Prague:

Group Captain EDWARD MOLE,
3 Red Place · Green Street
Mayfair, London, W.1

Tel.: Grosvenor 4360

META-SOKOL

Precision Sheet Metal Workers and Light Engineers to the Aircraft Industry

Manufacturers of fabricated parts and assemblies in ferrous and non-ferrous metals. Tools, jigs and machined parts for the assemblies can be produced in our own workshops.

Let us quote for your requirements.

M.O.S. Approved D.G.I. No. 50037 — Fully Approved A.R.B. Ref. No. A1/2502/47

C. W. FLETCHER & SONS LTD.
STERLING WORKS, ARUNDEL STREET,
SHEFFIELD, 1
ALSO MORTIMER WORKS, MATILDA LANE, SHEFFIELD, 1

Telephone: Sheffield 28049 & 28040 — ESTABLISHED 1891 — Telegrams: Assayed Sheffield 1

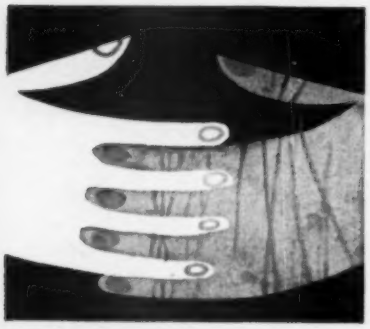
THE AEROPLANE PICTORIAL REVIEW (No. 3)

For the third year in succession, the best and most striking photographs to have appeared in THE AEROPLANE during the past twelve months are gathered together within the covers of one book, to form a brilliant pictorial record of aeronautical progress.

10s. 6d. net *or by post 11s. 7d. from the Publishers*

TEMPLE PRESS BOOKS

Bowling Green Lane, London, E.C.1



**smart hands—
or smarting hands?**

Dermatitis hurts. Both hands *and* production suffer. The difference between smart hands and smarting hands is a Rozalex Barrier Cream. There is a range of these creams to provide protection against almost all known industrial irritants. Rozalex have been specialising in barrier creams for over 30 years. Their full technical resources are available from Rozalex Ltd., 10 Norfolk Street, Manchester 2.

ROZALEX BARRIER CREAMS **protect**

R121E

SOLDERING EQUIPMENT BY LITESOL

PRECISION SOLDERING INSTRUMENTS for the ELECTRONICS INDUSTRY

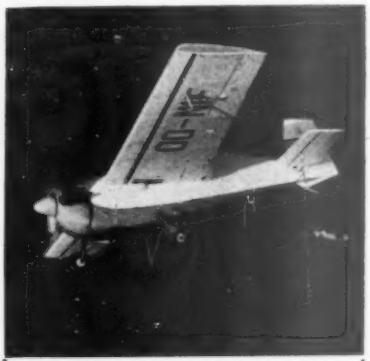
- Comprehensive Range
- Robust and Reliable
- Light weight
- Rapid heating
- Bit sizes 3/32in. to 3/8in.
- 'Permabit' or Copper Bits
- All voltage ranges 6/7v to 230/250v
- Prices from 19/6

British and Foreign Patents. Registered designs. Suppliers to H.M. and Foreign Governments. Agents throughout the world. Write for Booklet No. S.23

Illustrated is the 25 w 3/16 in. replaceable bit model with safety shield. Sole proprietors and manufacturers:—

LIGHT SOLDERING DEVELOPMENTS LTD.
28 Sydenham Road, Croydon, Surrey.

Telephone: CROydon 8589.
Telegrams: Litesold, Croydon.



("The Aeroplane & Astronautics" Copyright)

TIPSY NIPPER

Fully Aerobatic Less than £1,000

Ideal single-seat "aerial runabout."
45 m.p.g.
Cruising speed of 90 m.p.h.
Unique among car-engined (HEPU Volkswagen) lightweights in being fully (and delightfully) aerobatic.
Sturdy undercarriage, incorporating disc brakes and steerable nosewheel, gives tremendous manœuvrability and stands the strains of landing and taxying on virtually unprepared surfaces.
Total cost ex Gosselies airfield Belgium, £990 duty paid ; amateur construction kit £484 delivered free U.K.

Write for details to Sales Manager, Fairey Aviation Ltd., Hayes, Middlesex

CLASSIFIED ADVERTISEMENTS

PRESS DAY: Classified Advertisements must normally be received at Head Office by FIRST POST THURSDAY for the following Friday week's issue. Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES—10d. per word (minimum 12 words 10/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting £3-12-6 per single column inch. Centred lines £1. Series discounts of 5% for 13, 10% for 26 and 15% for 52 consecutive insertions, allowed to trade advertisers.

TERMS—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM—Facilities are available to readers to purchase advertised goods through "The Aeroplane and Astronautics." Commission 1% (minimum 2/-) on amount deposited.

BOX NUMBERS—Private advertisers desiring to have replies sent care of "The Aeroplane and Astronautics," may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. Box Numbers must not be used for the purpose of circularizing and the Proprietors do not undertake the distribution of such matter received. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box A000, care of "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus London Telex." Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50 Hertford Street, Coventry. Telephone: Coventry 62464. 1 Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

W. S. SHACKLETON LTD

Europe's Leading Aircraft Brokers

offer

PIPER COMANCHE

Several models available either 180 or 250 h.p. version.

This is just one of the many popular American light aircraft we can supply.

Full details upon request

W. S. SHACKLETON LTD.
175, Piccadilly, London, W.1

Phone: HYDe Park 2448-9 Cable: Shackhud, London

PIAGGIO EXECUTIVES

THE SIX/EIGHT SEATER P.166, THE P.136-L AMPHIBIAN AND THE AEROBATIC P.149-D CAN BE IMPORTED ON AN OPEN GENERAL LICENCE WITHOUT DOLLAR WORRIES.

Ask your dealer, or Write

Aero-Enterprises (Boreham Wood) Ltd.
17 Drayton Road, Boreham Wood, Herts.

AIR PARTS LIMITED

403 Caledonian Rd., London, N.7

Tel.: North 5018-9
Cables: Aircalv, London, N.7

For fully approved A.G.S. & A.N. hardware, quick service, enormous range. *Stock lists available.*

Overseas enquiries welcome.

Save Weight
Increase Payload
Carry More Passengers

Install

MALLITE EGB2 FLOOR PANELS

in your DC3, Viking or Ambassador Aircraft

Full details of the ARB approved installation are available.

WILLIAM MALLINSON and Sons Ltd.

130 HACKNEY ROAD LONDON E.2.

AIRCRAFT FOR SALE

R. K. DUNDAS, LTD.

THE popularity of Tripacers in this country continues to spread, their existence being evident at quite a number of aerodromes up and down the country.

WE are the only brokers who can offer you used Tripacers from 1952-1858 at really competitive prices, and within the price invite you to inspect the aircraft of your choice in New York, thus guaranteeing your satisfaction. We further give free and willing advice on all aspects of aviation, and are particularly expert in operating costs etc. You will be assured of service and satisfaction for all your aviation needs.

TRIPACERS. 1952, 1,850 total, Superhomers, £1,710; 1953, 1,320 total, Superhomers, £2,065; 1954 Super Custom Superhomers, 115 hr. engine, £2,165; 1955, Super Custom Superhomers, 913 s.m.o.h., £2,315; 1956, Super Custom, ADF LTRA-6 Rot. beacon, £2,985; 1957 Super Custom Superhomer, 400 total, £2,970; 1958 Super Custom, ADF Auto flight, 299 total, £3,430; 1958, Custom Comanche, 475 hrs. total, £5,115

R. K. DUNDAS, LTD., Dundas House, 59 Saint James's St., London, S.W.1. Phone, Hyde Park 3717. Cables, "Dundas, Piccy, London." 501-11

FOR SALE,

C-46F AIRCRAFT,

PASSENGER AND CARGO

WITH OR WITHOUT

T-CATEGORY KIT INSTALLED

IMMEDIATE DELIVERY.

THE FLYING TIGER LINE, INC.,

BURBANK, CALIF.

CALL OR CABLE.

FRED BENNINGER,

EXECUTIVE VICE-PRESIDENT.

Phone, Stanley 7-3411. Cable, "Flytiger."

501-656

TRAVELAIR, LTD.,

AIRCRAFT SALES AND FINANCING SPECIALISTS.

DOUGLAS D.C.3 passenger-cargo convertible, cargo doors. £19 000, or lease.

DOUGLAS D.C.6, just completed major overhaul.

DOUGLAS D.C.6A/B, offered for quick sale.

CONVAIR 240, just completed major overhaul, excellent condition. $200,000.

CONVAIR 440; now only four available, offers around $'25 000 considered.

HERON 1B, full airline standard, excellent condition. £20 000 or offers.

DOVE; several available at very low cost.

AND FOR THE PRIVATE AND BUSINESS PILOT

THE best American light aircraft offered via our New York associates, including Piper Apaches from £5,500 Commanches from £5,100, Cessna 182 from £4,300, Cessna 172 from £2,550, Beech Bonanza from £2 860; plus

MOONEY Mk. 20 series, the finest value in new American 4-seat aircraft. We are the U.K. distributors and will be pleased to arrange demonstrations and provide fullest information.

H.P. Terms gladly arranged, and for full details contact:—

TRAVELAIR, LTD., 115 Oxford St., London, W.1. Phone, Gerrard 3382. 501-15

ROLLASONS for Tiger Moths. Croydon 5151. zzz-708

TIGER Moths. Choice of two G-AJHN airframe 1770, engine 240, C. of A. July, 1960, £700. G-ANSM airframe 3010, engine 870, C. of A. January, 1960, £550. Bristol and Wessex, Bristol Airport, Lulsgate 444. 501-6

Aircraft Wanted

SCRAP aircraft, aluminium and stainless steel, urgently required. Lowton Metals, Ltd., Lowton Saint Mary's, near Warrington. Leigh 1444-5. zzz-711

CHIPMUNK aircraft, fully modified required. Box A014, care of THE AEROPLANE AND ASTRONAUTICS. 501-x9536

AIRCRAFT ACCESSORIES, SPARES AND COMPONENTS

COMPONENTS, spares and instruments for all aircraft and engines. A.R.B. released. Airtrade, Ltd., Croydon Airport. Phone, Croydon 0643. zzz-715

ROLLASONS for Tiger Moth and Gipsy engine spares. Croydon 5151. zzz-709

REPAIRCRAFT, LTD., The Common, Cranleigh, Surrey. (Cranleigh 536.) For instrument and autopilot overhauls. zzz-701

PHILLIPS AND WHITE, LTD.

OFFER from stock a comprehensive range of new spares and components for the following engines: CHEETAH IX, X and XV, de Havilland Gipsy, Major and Queen series.

INSTRUMENTS and instrument parts, navigational equipment, electrical components and aircraft spares are also available from stock.

61 QUEENS GARDENS, London, W.2. Phone, Ambassador 8651, 2764. Cables, "Gyrair London." zzz-670

THE REGIONAL AIR TRADING CO., Croydon Airport, for Rapide spares of every description. Phone, Croydon 8521. zzz-714

ROLLASONS are specialists in the overhaul of all Gipsy engines. Croydon 5151. zzz-710

AIRFRAME spares for Dakotas, Harvards, Piper Club, Fairchilds, Argus, Beechcraft D-17S Mosquito, Spitfire, Firefly. Engine spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc. Accessories and instruments for all types of aircraft. A. J. WALTER, LTD., The Drive, Horley, Surrey. Phone, Horley 1420 and 4294. Cables, "Cubeng, Horley." 501-12

TIGER MOTH spares, flying wires, undercarriage legs, wings, propellers, blind-flying hoods. Vendair (London), Ltd., Croydon Airport. Cro 5777. 501-16

HELICOPTERS

HELICOPTER SERVICES, LTD., offer their aircraft for all charter services. 96 Piccadilly, London, W.1. Gro 5495-6. zzz-717

APPOINTMENTS BUREAUX

AIR crew and executives desirous of entering commerce due to the present state of the aviation industry should immediately contact:—

PLANAVIA International Aeronautical Appointments Bureau, 338 Kilburn High Rd., N.W.6. Mal 3142. 501-14

CLOTHING

R.A.F. Officers' uniforms for sale, new and reconditioned. Fisher's, 86-88 Wellington St., Woolwich. Phone 1055. Kit also purchased. zzz-707

CONSULTANTS

R. H. STOCKEN, F.R.Ae.S., Eagle House, 109 Jermyn St., S.W.1. Whitehall 8863. zzz-696

R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdown Place, Cheltenham. Phone 5811. 508-8865

ENGINES AND ENGINE SPARES

GIPSY Major Mk. 10 and Mk. 1 engines, part-exchange offered with your time-expired engine. Propellers for most types of light aircraft. Mitchell Aircraft, Ltd., The Airport, Portsmouth. Phone 717641. zzz-689

ENGINE overhauls. Hants and Sussex Aviation Ltd., offer Britain's most comprehensive overhaul service, including magneto and component overhaul with spares supply. All D.H. range up to Queen 30 Mk. 2 for Heron. Armstrong Siddeley, Blackburn Cirrus, Lycoming, and United Kingdom distributors of Continental motors. Huge exchange pool most types engines. Specialists in export work. Address, The Airport, Portsmouth, Hants. Phone 63051. 501-693

HIRE AND CHARTER

RAPIDES for hire or charter. A. J. Whittemore (Aeradio), Ltd., Croydon Airport, Surrey. zzz-683

NOTICES

AIR TRANSPORT ADVISORY COUNCIL.

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM SILVER CITY AIRWAYS, LTD., OF 62 BROMPTON ROAD, LONDON, S.W.3:—

APPLICATION NO. 11/5 for an extension from March 31, 1960 to March 31, 1967 of the period of approval of the seasonal Normal Schedule Service which they are authorized to operate on the route Lydd or Manston-Le Touquet, with DH89, Dakota, Bristol 170 and Hermes aircraft, at a frequency of 12 return flights daily.

APPLICATION NO. 29/5 for an extension from March 31, 1960 to March 31, 1967 of the period of approval of the seasonal Normal Schedule Service which they are authorized to operate on the route Lydd or Manston-Ramsgate (opt)-Ostend, with DH89, Dakota, Bristol 170 and Hermes aircraft at a frequency of 21 return flights weekly during April and May and 50 return flights weekly from June to September each year, and also for permission to operate from March 1 each year.

APPLICATION NO. 56/3 for an increase from 15 return flights daily to a frequency in accordance with traffic demand on the Vehicle Ferry service which they are authorized to operate with Bristol 170 and Dakota aircraft on the route Southampton and/or Hurn and/or Gatwick-Cherbourg until December 31, 1961.

APPLICATION NO. 90/4 for an extension from March 31, 1960 to March 31, 1967 of the period of approval of the U.K. Internal Service which they are authorized to operate between Newcastle and Blackpool with Dakota, Bristol 170 and Heron aircraft at a frequency of 8 return flights weekly, and also for permission to integrate it with their Normal Scheduled Service on the route Newcastle-Amsterdam-Dusseldorf (Application No. 94) and with the U.K. Internal Service of Manx Airlines, Ltd. between Ronaldsway and Newcastle (Application No. 61).

APPLICATION NO. 94/5 for an extension from March 31, 1960, to March 31, 1967, of the period of approval of the Normal Scheduled Service which they are authorized to operate on the route Newcastle-Amsterdam-Dusseldorf with Dakota, Bristol 170 and Heron aircraft, at a frequency of seven return flights weekly, and also for permission to integrate it with their U.K. Internal Service between Newcastle and Blackpool (Application No. 90).

APPLICATION NO. 95/4 for an extension from March 31, 1960, to March 31, 1967, of the period of approval of the Normal Scheduled Service which they are authorized to operate on the route Newcastle-Leeds (opt.)-Brussels, with Dakota, Bristol 170 and Heron aircraft at a frequency of three return flights weekly.

APPLICATION NO. 131/4 for an extension from December 31, 1959, to December 31, 1966, of the period of approval of the U.K. Internal Service which they are authorized to operate between Blackpool (Squires Gate) and Isle of Man (Ronaldsway), with Dakota, Bristol 170 and Heron aircraft, at a frequency of 24 return flights daily, with an additional six return flights on Saturdays during July and August, each year, and also on Senior T.T. Race days.

APPLICATION NO. 133/2 for an extension from October 31, 1959, to October 31, 1966, of the period of approval of the seasonal U.K. Internal Service which they are authorized to operate between the Isle of Man (Ronaldsway) and Birmingham (Elmdon) with Dakota, Bristol 170 and Heron aircraft, from April 1 to October 31 each year, at a frequency of 20 return flights weekly.

APPLICATION NO. 135/4 for an extension from September 30, 1959, to October 31, 1966, of the period of approval of the seasonal U.K. Internal Service which they are authorized to operate on the route Blackpool (Squires Gate)-Liverpool (Speke) (tech.)-Jersey with Dakota, Bristol 170 and Heron aircraft, from May 4 to September 30 each year, at a frequency of two return flights each Friday, Saturday, Sunday and Monday, and also for permission to operate from April 1 to October 31 each year on the amended route Blackpool (Squires Gate)-Liverpool (Speke) (tech.)-Guernsey (opt.)-Jersey.

APPLICATION NO. 465/3 for an amendment to the terms of approval of the seasonal U.K. Internal Service which they are authorized to operate between Leeds and Jersey with Dakota and Heron aircraft, at a frequency of four return flights weekly each Friday and three return flights weekly each Saturday and Sunday, from May to September each year until September 30, 1961, and which they have previously applied to operate at a frequency of 10 return flights weekly on Fridays, Saturdays and Sundays, with not more than five return flights on any one day, so as now to permit them to operate on the route Leeds-Guernsey (opt)-Jersey.

FROM MANX AIRLINES LTD., OF RONALDSWAY AIRPORT, ISLE OF MAN:—

APPLICATION NO. 61/2 for an extension from September 30, 1959, to September 30, 1966, of the period of approval of the seasonal U.K. Internal Service which they are authorized to operate between Ronaldsway and Newcastle, with Dakota, Bristol 170 and Heron aircraft, at a frequency of 18 return flights weekly from May to September each year, and which they are permitted to integrate with their Ronaldsway-Carlisle service (Application No. 60), and also for permission to operate the service from March 1 each year and to integrate it with the U.K. Internal Service operated by Silver City Airways Ltd. between Newcastle and Blackpool (Application No. 90).

Continued at top of next classified column.

HANDLEY PAGE (Reading) LTD.,
THE AERODROME, WOODLEY, READING

have the following vacancies in their expanding Design Offices for work on Civil Aircraft.

SENIOR AERODYNAMICIST who will also act as ASSISTANT CHIEF AERODYNAMICIST. Applicant should have a degree and several years' practical experience. Successful applicant will be offered a house to rent.

TEST ENGINEERS for Structural and Mechanical Testing and for Electrical and Mechanical Testing, experience on strain gauge work, instrumentation and vibration testing.

DRAUGHTSMEN. Senior Electrical Draughtsmen who must have had several years' aircraft electrical experience.
Intermediate Electrical Draughtsmen preferably with aircraft experience.
Intermediate Draughtsman with experience in modern radio installation in aircraft.
Design Draughtsmen with aircraft structural experience.

PLANNING ENGINEERS for aircraft structures.

ELECTRICAL ILLUSTRATOR. Capable of preparing Electrical Diagrams for Maintenance Manual from Design Office Drawings.

WEIGHTS ENGINEER. High commencing and progressive salaries are offered.

Please send full particulars of experience, etc., to the Personnel Officer.

THE BRITISH AIRLINE PILOTS ASSOCIATION
81, New Road, Harlington, Middx. *Tel. HAYes 3442/3*

Membership open to all Commercial and Service Pilots. For full details as to Objects and particulars of Membership, please write to General Secretary.

Southend Municipal Flying School
Commercial and Private Pilot's Licence.
Instructors Rating. Night Flying every night.
No entrance fee or subscription.
Austers £4 5s., Chipmunks £5 5s., dual or solo.
Contract rate £3 15s.
Municipal Airport, Southend-on-Sea, Essex
Phone: Rochford 56204

HANDLEY PAGE LTD.
Vacancies exist in our Research Department for:
(1) Mathematician with Honours Degree to assist in further development and application of methods of calculating the behaviour of laminar boundary layers.
(2) Aerodynamicist with University Degree and preferably some experience for project performance calculations.
Applications, which will receive confidential treatment, should be addressed to:
Dr. G. V. Lachmann, Director of Research,
HANDLEY PAGE LTD.
Cricklewood, London, N.W.2

Continued from previous classified column

APPLICATION NO. 65/2 for an extension from April 30, 1960, to April 30, 1967, of the period of approval of the U.K. Internal Service which they are authorized to operate with Dakota, Bristol 170 and Heron aircraft on the route Ronaldsway-Glasgow (Renfrew) at a frequency in accordance with traffic demand, and on the route Ronaldsway-Glasgow (Renfrew) (opt)-Edinburgh at a frequency of six return flights daily on Fridays, Saturdays and Sundays from May to September each year.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 501-5

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143-9 Fenchurch St., E.C.3. Phone, Mansion House 3089. Official packers and shippers to the aircraft industry. zzz-674

PHOTOGRAPHY

AEROPLANE photographs, 5,000 available including 1914-18 warplanes, latest U.S.A. and British jets, 5½ x 3½ in., 7s. 6d. per dozen. Lists and specimen 2s. 6d. post free; also thousands of ships and railways. Real Photographs, Ltd., Victoria House, Southport. 501-4

RADIO AND RADAR

SPERRY Zero reader, Type ZL1 course selectors, control panels, flight computors and indicators, three complete installations in stock. A. J. Whittemore (Aeradio), Ltd., Croydon Airport, Surrey. zzz-684

STR12D, STR9Z, STR9X and most other British and American V.H.F., R/T equipment always in stock. A.R.B.-approved design installations into any type of aircraft. A. J. Whittemore (Aeradio), Ltd., Croydon Airport, Surrey. zzz-685

RADAR height-finding cabins, type 13/6, practically complete. Offers required. Box A011, care of THE AEROPLANE AND ASTRONAUTICS. zzz-218

SITUATIONS VACANT

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "No pass, no fee" terms. Over 95% successes. For details of exams and courses in all branches of aeronautical work, aero engines, mechanical engineering, etc., write for 148-page handbook—free. B.I.E.T. (Dept. 703), 29 Wright's Lane, London, W.8. zzz-690

AIR Traffic Controller required. Would suit ex-R.A.F. approach controller, must have M.T.C.A. certificate of competency. Write, stating age, experience, etc., to Personnel Officer, Field Aircraft Services, Ltd., The Aerodrome, Burton on the Wolds, nr. Loughborough, Leics. 501-8872

STRESSMEN. Minimum three years' experience plus H.N.C. Western Stressmen's Registry, 39 Western Gardens, London, W.5. 502-8871

CHIEF FLYING INSTRUCTOR—Glamorgan Flying Club. Applications are invited from fully rated instructors with current commercial licence, Royal Aero Club Observer's Certificate and R.A.F. approval for Cadet training. Auster, Jackaroo, Tiger Moth and Prentice aircraft, full Link facilities, attractive salary, pleasant surroundings offered to really keen man between 27 and 45. Applications to Glamorgan Aviation, Ltd., Quay Street Chambers, Cardiff. 501-1

THE GENERAL ELECTRIC CO., LTD.,

ATOMIC ENERGY DIVISION,

INVITES APPLICATIONS FOR A POSITION IN

THEIR STRUCTURAL DEVELOPMENT

LABORATORY AT ERITH.

Applicants should be university graduates with an interest in structural test work. Previous experience of this type of work is desirable though not essential. It will be the duty of the successful candidate to design and order all necessary test components, carry out liaison and supervision of the drawing, construction and testing of rigs and to report on the test results.

Applications are also invited for mechanical or structural honours graduates interested in the basic design and analysis of complex steel structures, stress analysis of shells, evaluation of temperature stress distributions, mechanical vibrations, and pipework calculations. Previous experience of some aspects of this work is desirable though not essential.

APPLY:

PERSONNEL MANAGER (DWB/10),

THE GENERAL ELECTRIC CO., LTD.,

ERITH, KENT. 501-9

SEVERN-LAMB, LTD., have additional capacity in their new premises for scale models, sectioning, exhibition finishing, prototype and development work of all kinds. Inquiries welcomed. Western Rd., Stratford-on-Avon. Phone, S.-on-A. 3878. 501-8

HUNTING AIRCRAFT LIMITED

require

STRESS ENGINEERS

for their LONDON Design Office.

Qualifications H.N.C. or equivalent and at least two years' stressing experience. Interesting design work on Civil jet transport and research aircraft.

Contributory Staff Pension and Life Assurance Scheme. Holiday arrangements honoured for current year.

Applications, giving full details of qualifications, experience, age and salary required, and quoting ref. HAL/88/8 should be forwarded to :

The Personnel Manager,
HUNTING AIRCRAFT LTD.,
The Airport, Luton, Beds.

Viking, Consul and Bristol Aero Engine Spares

BRAND NEW AND RELEASED
PRICES SENT ON REQUEST

Having acquired all British West Indian Airways and Central African Airways spares, we can offer delivery of most components ex stock at extremely competitive prices.

AIRLINE AIR SPARES LTD.

SOUTHEND AIRPORT
SOUTHEND-ON-SEA, ESSEX

Telephone : ROCHFORD (Essex) 56881-2-3
Telex 1943

For A.O.G. services after office hours :
Telephone Mr. Edwards, Southend 47828 ;
Mr. Noble, Southend 43863.

HANDLEY PAGE LIMITED

require a

MATHEMATICIAN

for Pegasus Digital Computer Programming.

Applicants with either a 1st or 2nd class honours mathematics degree must have suitable experience of programming for the Pegasus Computer.

An engineering background, not necessarily in aircraft, would be an advantage.

The position offers opportunity for future advancement, and a salary commensurate with the level of duties undertaken. Five day week. Staff pension scheme.

Please write to: STAFF OFFICER,
HANDLEY PAGE LTD.,
Cricklewood, London, N.W.2

FLIGHT radio officer required immediately for service overseas. This appointment is more suited to a bachelor, but applications from married men prepared to accept family separation will be considered. Brief details of age, marital status, qualifications and experience, should be sent to Box A012, care of THE AEROPLANE AND ASTRONAUTICS. 502-8876

ASSISTANT signals officers required by International Aeradio, Ltd., for service overseas. Experience in aviation communications essential and some technical training desirable. Preferably single, between 25 and 30 years. Permanent and pensionable positions with inclusive salary, accommodation, marriage and child differentials. U.K. leave, free air passages and insurance, kit allowance. Qualified candidates, to whom replies will be sent, write to Staff Superintendent, 40 Park St., London, W.1. 501-7

AIR MINISTRY have vacancies for civilian radio technicians at Royal Air Force, Sealand, Cheshire, and at certain other R.A.F. stations throughout the United Kingdom for the servicing, repair, modification and testing of air and ground radio and radar equipment; commencing salary (national) (according to age) is £525-£670 p.a.; max. salary £795 p.a.; rates are subject to small deduction at certain provincial stations and to a small increase in London; annual leave 3 weeks 3 days increasing to 4 weeks after 3 years' service; a limited number of houses may be available for renting at Sealand; these houses are at West Kirby, some 15 miles distant. Apply, giving details of qualifications and experience and mentioning this advertisement, direct to the Commanding Officer, No. 30 Maintenance Unit, Royal Air Force, Sealand, or to Air Ministry, C.E.4b, Cornwall House, Waterloo Rd., London, S.E.1, for vacancies in other areas. 501-10

SITUATIONS WANTED

AIRLINE Pilot (12,000 hrs.) currently employed by Eastern Airline as Dakota Captain (6,000 hrs.), seeks new position, air or ground, when present contract expires in October. Willing to go anywhere. International experience on Constellations and others. Senior Check Captain on Dakotas. Flight Nav. licence, not current, Australian, adaptable. Available early November. Please reply to Box A994, care of THE AEROPLANE AND ASTRONAUTICS. 502-8873

C.F.I. /Manager, C.P.L., M.C.A./R.A.F. approved seeks permanent post. Box A013, care of THE AEROPLANE AND ASTRONAUTICS. 501-x9535

COMMERCIAL pleasure flight pilot with four years at seaside resort seeks change into similar type of work, home or abroad. Available October or next April. Single and twin ratings. D. Jackson, Spaldington, Howden, East Yorkshire. 501-x9573

PILOT, 25, C.P.L., 250 hours, requires position; anything considered; willing to obtain ratings at own expense. Box A015, care of THE AEROPLANE AND ASTRONAUTICS. 501-x9599

TUITION

EXETER AIRPORT, LTD. Courses for Commercial Pilot's Licence, from £625; Private Pilot's Licence from £101 5s. Contract rate solo flying. Austers and Tigers, £2 17s. 6d. per hr.; normal dual/solo rates, £3 7s. 6d. per hr.; twin conversions, £6 12s. per hr.; Chipmunk, £5 5s. per hr.; Messenger, £4 18s. 6d. per hr. Limited accommodation £5 15s. 6d. per week. Exeter Airport, Exeter. Phone 67433. zzz-705

CIVIL pilot-navigator licences.

AVIGATION, LTD., provide full-time or postal tuition or a combination of either of these methods to suit individual requirements for the above licences. Classroom instruction can be provided for A.R.B. General, certain specific types and performance schedule examination. Link Training Department at Monarch 1364.

FOR full details apply to the Principal,

AVIGATION, LTD.,
30 CENTRAL CHAMBERS,
EALING BROADWAY,
LONDON, W.5.
Phone, Ealing 8949. zzz-699

LEARN to fly. £32 instructors' licences and instrument flying for £4 per hour; night flying £5 per hour. Residence 6 gns. weekly. Approved M.T.C.A. Private Pilot's Licence course. Specialized course for Commercial Pilot's Licence. Wiltshire School for Flying, Ltd., Thruxton Aerodrome (Andover Junction 1 hr. 15 min. from Waterloo), Hants. zzz-700

PLYMOUTH. Ideal training area in holiday district for commercial and P.P.L. training. Tiger and Auster, £3 7s. 6d. per hr. Contract rate £2 17s. 6d. solo. Chipmunks for advanced flying £5 5s. Night flying available. Individual tuition with guided study. Plymouth Airport, Ltd., Crownhill, Plymouth 72752. zzz-704

CAMBRIDGE AERO CLUB. M.T.C.A.-approved private pilot's licence course, 30 hours, £3 10s. per hour; D4 Link Trainer for radio compass and I.L.S. procedures to instrument rating standard, £1 per hour; instructor's courses, £3 10s. per night; night flying, £4 10s. per hour; Auster J.1.N., £3 15s. per hour, dual and solo. No fees or subscriptions. Club operates on all days, including week-ends. The Aerodrome, Newmarket Rd., Cambridge. Phone 56291. zzz-703

LINK instruction to instrument rating standard. D.4 available at 25s. per hour at Biggin Hill, Green Line 705 from Victoria or Bromley South. Maitland Air Charters, Ltd. Phone, Biggin Hill 2277. 503-1299

AIRWAYS AERO ASSOCIATIONS, LTD., Biggin Hill. M.T.C.A. approved P.P.L., C.P.L., I/R courses, Chipmunk, Aiglet, Proctor and twin-engined Super Aero. Competitive contract rates. Biggin Hill (BN9) 2735. 511-8875

BRITISH WIRE THREAD INSERTS

Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.

B.S.F.
Metric
B.S.P.
B.A.
Whitworth
Unified.

CROSS
MANUFACTURING CO. (1938) LTD.
COMBE DOWN, BATH, SOMERSET
Phone: COMBE DOWN 2355/8 *Grams:* CIRCLE' BATH

Air Traffic Control Officers

for

MINISTRY OF TRANSPORT AND CIVIL AVIATION

Age 23 to 35. Good education and recent aircrew or air traffic control experience essential. Salaries : while training £700 to £1,005 according to age ; when fully trained according to age and station approx. £860 at age 25 ; £1,035 at age 30 or over rising to £1,395. Promotion prospects. Write for further particulars and application form to M.T.C.A. (ESB1/ATCO), Berkeley Square House, London, W.1, or to the Civil Service Commission (No. 4904/59), Burlington Gardens, W.1.

HUNTING AIRCRAFT LIMITED

require

for the Aerodynamics Department

Performance Engineers
Project Aerodynamicists
Stability and Control Specialists

Contributory Pension and Life Assurance Scheme

Applications, giving full details of qualifications, experience, age and salary required and quoting ref. H.A.L./90/7, should be forwarded to :—

The Personnel Manager,
Hunting Aircraft Limited,
Luton Airport,
Beds.

SURREY AND KENT FLYING CLUB, Biggin Hill. Tiger, Hornet and Leopard Moths, Chipmunk and Prentice. Green Line 706 direct in one hour from London. Biggin 2235. 501-713

THE COLLEGE OF AERONAUTICS.

A SHORT COURSE ON

AIRCRAFT GAS TURBINE THEORY AND DESIGN

WILL BE HELD AT THE COLLEGE FROM MONDAY, NOVEMBER 2, TO FRIDAY, NOVEMBER 20, 1959.

The course will deal mainly with performance, systems, turbomachine aerodynamics and related design topics, but will include some experimental work on engines.

Fees for the course are £70 inclusive of full board and residence.

Further details and copies of the syllabus may be obtained on application to The Warden, The College of Aeronautics, Cranfield, Bletchley, Bucks. 501-2

MORLEY AVIATION, LTD. (Herts and Essex Aero Club, 1958), Aerodrome, Stapleford. M.C.A.-approved private pilot's licence course, Auster, Gemini and Tiger aircraft; trial lesson 35s.; 15 miles centre of London. Central Line Underground to Theydon Bois, bus 250 to club; open every day. Phone, Stapleford 257. 501-695

Hawker Siddeley Aviation LIMITED

GUIDED WEAPONS

MECHANICAL ENGINEERS

The Weapons Research Division of A.V. ROE & CO. LTD. requires Mechanical Engineers at Woodford Aerodrome, Cheshire, for work on advanced propulsion systems in connection with an air-to-ground strategic guided missile project.

Successful applicants will have excellent prospects within the Division which is pleasantly situated in rural Cheshire, yet close to housing and shops and on a main bus route. Canteen and social facilities are available and a Hawker Siddeley Group Pension Scheme is operated.

Applications, quoting reference No. R.160/A, should be addressed to:—

The Chief Engineer
A. V. ROE & CO. LTD.
Woodford Aerodrome, Cheshire.

LONDON SCHOOL OF AIR NAVIGATION, approved by Ministry for Commercial and I/Rating Personal coaching establishment, "the key of success" for all private and professional pilot and navigator qualifications, "refresher courses," home-study excellent alternative, type ratings, performance, Link and procedures, R/T, flying training. Officially appointed by H.M. Services for correspondence scheme—refer Education Officer, or direct, 33 Ovington Square, Knightsbridge, London, S.W.3. Ken 8221. zzz-0712

AIRWORK SCHOOL OF AVIATION. PERTH.

M.T.C.A.-APPROVED courses for private and commercial licences and instrument rating; residential and recreational facilities. Prospectus from Airwork Services, Ltd., 35 Piccadilly, London, W.1, or Perth Aerodrome, Scotland. 501-3

A.S.T. Offers ab initio or refresher flying/technical training for C.P./I.R., A.T.P. and Group "A" Performance Rating. For details, apply The Commandant, Air Service Training, Ltd., Hamble, Southampton. Phone, Hamble 3001-9. 501-13

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL. Commercial and private pilots training; night flying every night; Austers and Chipmunks from £3 15s. No entrance fee or subscription. Municipal Airport, Southend-on-Sea, Essex. Phone, Rochford 54204. 501-698

BOOKS AND PUBLICATIONS

THE "POWER AND SPEED" SERIES FOR BOYS. "Aircraft and Air Power," by F. G. Swanborough, of THE AEROPLANE AND ASTRONAUTICS, has been written for intelligent boys between the ages of 10 and 16. The author surveys modern military flying and includes chapters on combat aircraft, scientific aids and missiles. Other titles in this series are "Motorcars," "Locomotives" and "Ships and Shipbuilding." Illustrated, 112 pages, 10s. 6d. net from booksellers, or 11s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

PRINCIPLES OF HELICOPTER ENGINEERING, by Jacob Shapiro. This comprehensive review of the engineering principles governing the design and construction of helicopters provides a complete survey of present knowledge in the field. Illustrated. 448 pages. 55s. net from booksellers, or 56s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

THE EXPLORATION OF SPACE (First Cheap Edition), by Arthur C. Clarke. Provides answers to the many questions the intelligent layman asks about the science of "astronautics." Over 375,000 copies sold in all editions. Illustrated. 212 pages. 8s. 6d. net from booksellers, or 9s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" DIRECTORY OF BRITISH AVIATION, 1959. Incorporating "Who's Who in British Aviation." The current edition of this established annual reference work provides a complete and up-to-date guide to Service and Civil Aviation throughout the British Commonwealth. Contains full particulars of United Kingdom and Commonwealth Air Forces, Ministries, Organizations, Airlines, Industries, Flying Clubs and Aerodromes, and a Biographical Section with over 1,650 entries. 648 pages, price 30s. from booksellers, or 31s. 6d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" PICTORIAL REVIEW (No. 3). Compiled by the staff of THE AEROPLANE AND ASTRONAUTICS. This is the third annual miscellany of illustrations to appear in THE AEROPLANE AND ASTRONAUTICS, and covers highlights of aviation for the year ending autumn, 1958. Over 250 illustrations, 128 pages, 10s. 6d. net from booksellers, or 11s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" DIARY, 1959. Compiled by the staff of THE AEROPLANE AND ASTRONAUTICS. Contains brief specifications of British civil, military and research aircraft (48 of which are illustrated), lists of British aircraft and aero-engine constructors, organizations, flying records, Royal Air Force Commands, and a vocabulary of aeronautical terms in six languages. Illustrated, 75 pages plus diary, 4s. 3d. net (Rexine) (including purchase tax) from booksellers, or by post 4s. 9d. from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

INTERPLANETARY FLIGHT (3rd Impression), by Arthur C. Clarke. Describes the problems to be solved before space travel becomes a reality and the form rockets and spaceships may take. Illustrated, 169 pages, 9s. 6d. net from booksellers, or 10s. 2d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"CAMERA IN THE SKY," by Charles Sims, with a preface by Air Chief Marshal Sir James Robb. For more than 30 years Charles Sims, chief photographer of THE AEROPLANE AND ASTRONAUTICS and one of Britain's best-known aerial photographers, has watched the amazing growth of British aviation from a ring-side seat. In this book he recalls with pen and camera, enlivened with anecdote, some of his many memories of those eventful days. Illustrated, 218 pages, 25s. net from booksellers, or 26s. 6d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

Books and Publications Wanted

OLD aviation and airship books wanted by world's largest dealer in aeronautical literature. Cash by return of post. Stuart, Fairlight Hall, Hastings. zzz-716

FREE! TO AMBITIOUS ENGINEERS 144-PAGE BOOK

Full details of the easiest and quickest way to prepare for A.F.R.Ae.S., A.R.B. Licences, B.Sc.(Eng.), A.M.I.Mech.E., City & Guilds, and hundreds of Home Study Courses in all branches of Aeronautical, Mechanical & Electrical Eng., Draughtsmanship, R.A.F. Maths., etc., are given in this valuable book. Our Courses have been approved by Royal Aeronautical Society and many B.I.E.T. Students have obtained First Places in the A.F.R.Ae.S. Exams.

We definitely Guarantee
NO PASS—NO FEE

A copy of this enlightening Guide to well-paid posts will be sent on request—
FREE! Write: B.I.E.T., 305a COLLEGE HOUSE, 29-31, WRIGHT'S LANE, LONDON, W.8.
BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

CROSS PERFECT PRECISION AIRCRAFT SPRING WASHERS
TO B.S. SPECIFICATION 2 SP.47
CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH. Tel.: Combe Down 3055/8

INDEX TO ADVERTISERS

Name	Page
A	
Aero-Enterprises (Boreham Wood), Ltd.	25
Airline Air Spares, Ltd.	27
Air Parts, Ltd.	25
Alvis, Ltd.	17
Armstrong Whitworth, Equipment	18
Avica Equipment, Ltd.	23
B	
Boulton Paul Aircraft, Ltd.	5
B.P. Aviation Services, Ltd.	14
Bristol Siddeley Engines, Ltd.	21
British Airline Pilots Association, The	26
British Institute of Engineering Technology	28
Burnley Aircraft Products, Ltd.	20
C	
Convair, a Division of General Dynamics Corporation	6
Cross Manufacturing Co. (1938), Ltd.	27, 28
D	
Dassault, Marcel, Générale Aéronautique	7
Dowty Equipment, Ltd.	Inside Back Cover
F	
Fairey Aviation, Ltd.	Front Cover, 24
Fletcher, C. W., & Sons, Ltd.	24
H	
Handley Page, Ltd.	12, 26, 27
Hawker Siddeley Aviation, Ltd.	28
Hunting Aircraft, Ltd.	27
L	
Light Soldering Developments, Ltd.	24
Lockheed Aircraft Corporation	10, 11
Lockheed Precision Products Ltd.	Inside Front Cover
M	
Mallinson, William, & Sons, Ltd.	25
Ministry of Transport & Civil Aviation	27
Mole, Group Captain Edward	24
N	
Northern Aluminium Co., Ltd.	8, 9
P	
Power Auxiliaries, Ltd.	22
R	
Redifon, Ltd.	16
Rolls-Royce, Ltd.	15
Rotax, Ltd.	19, Back Cover
Rozalex, Ltd.	24
S	
Shackleton, W. S., Ltd.	25
Smiths Aircraft Instruments, Ltd.	1-4
Southend Municipal Flying School	26
V	
Vickers-Armstrongs (Aircraft), Ltd.	13

Printed in England and Published Weekly by the Proprietors, TEMPLE PRESS LIMITED, BOWLING GREEN LANE, LONDON, E.C.1.
Registered at the G.P.O. as a Newspaper. Second class postage paid at New York, N.Y.

AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette, et Cie, Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson Subscription Service Ltd., Toronto; Gordon & Gotch Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th Street, New York, 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 100 Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

ARMSTRONG
WHITWORTH
'ARGOSY'

DOWTY
Equipped

Undercarriages · Propellers · Hydraulics · Electrics

DOWTY GROUP LIMITED · CHELTENHAM

RECORD OF ACHIEVEMENT

INERTIA

ELECTRIC

H_2O_2

CORDITE

IPN

FUEL AIR

HTP

LOW PRESSURE AIR

STARTING
SYSTEM
SPECIALISTS

for 20 years...

COMBINED LOW PRESSURE AIR & FUEL AIR SYSTEM

...and for the Future

ROTAX

ROTAX LTD · ENGLAND · AUSTRALIA · CANADA